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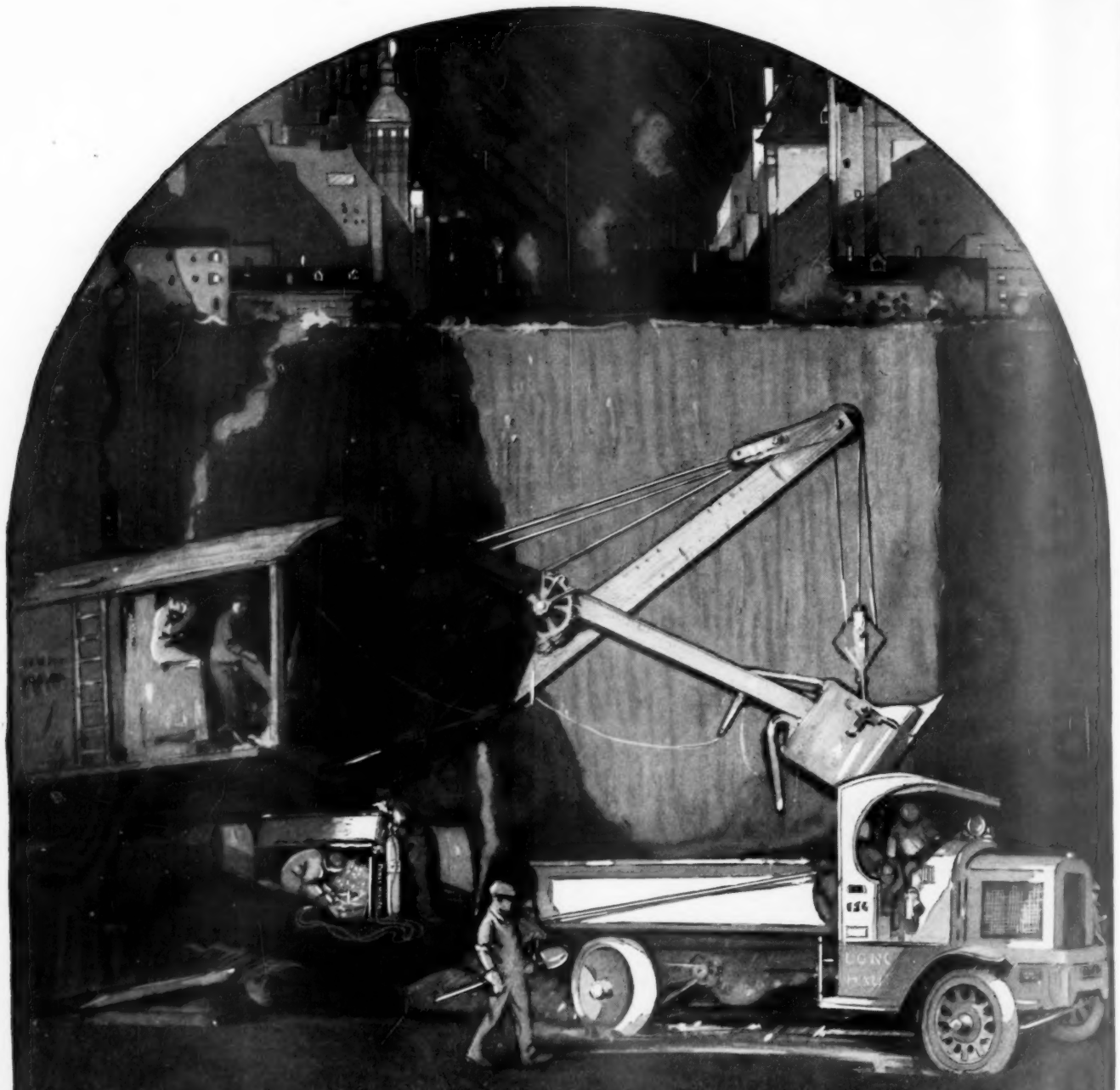

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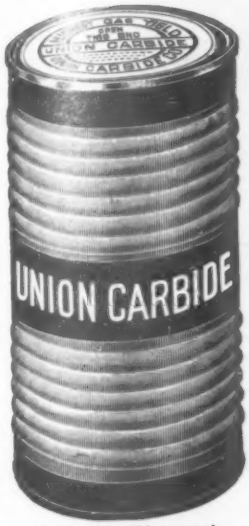

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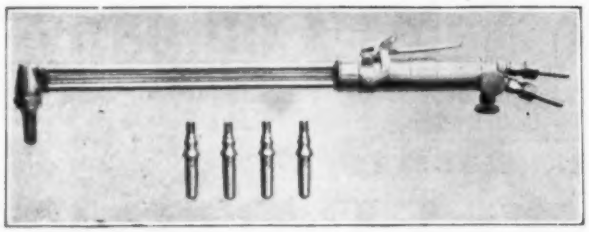

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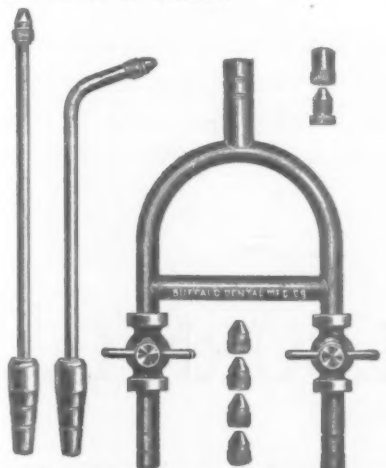

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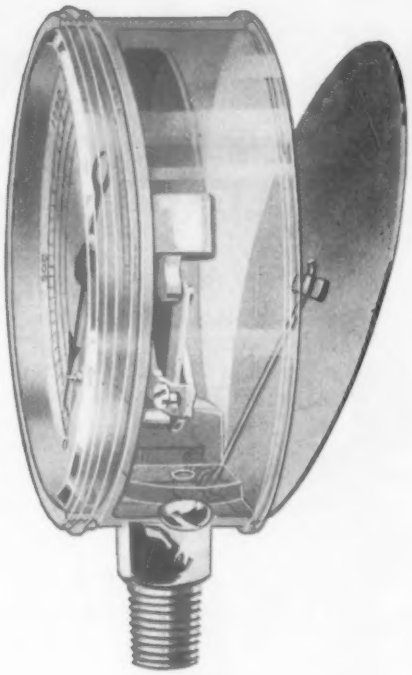

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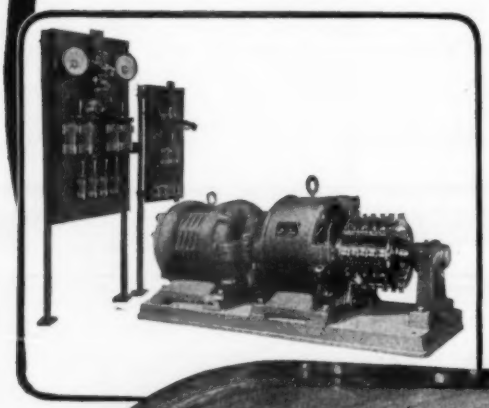

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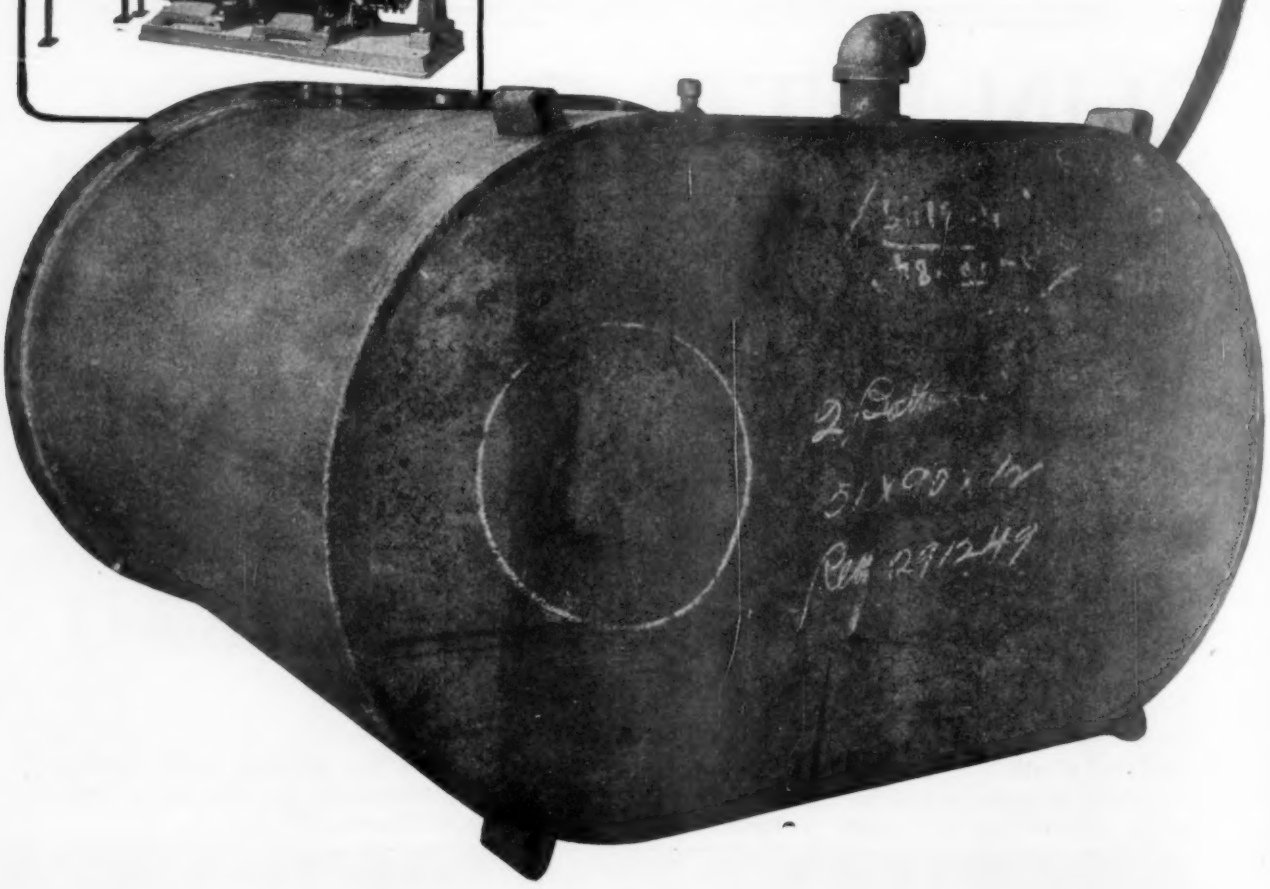

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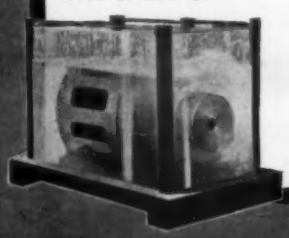

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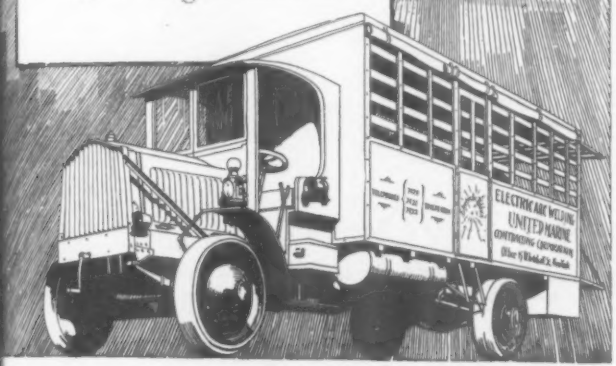

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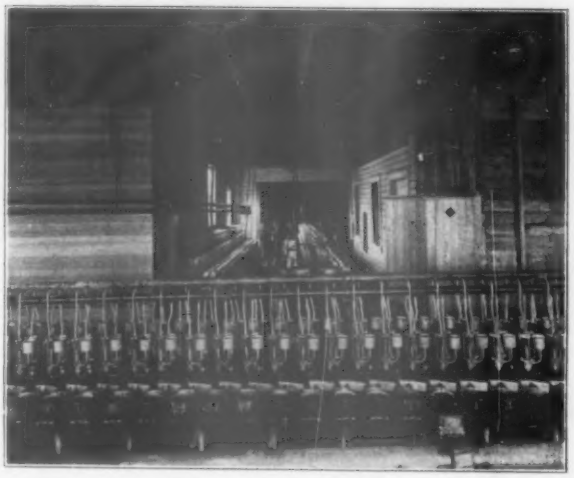

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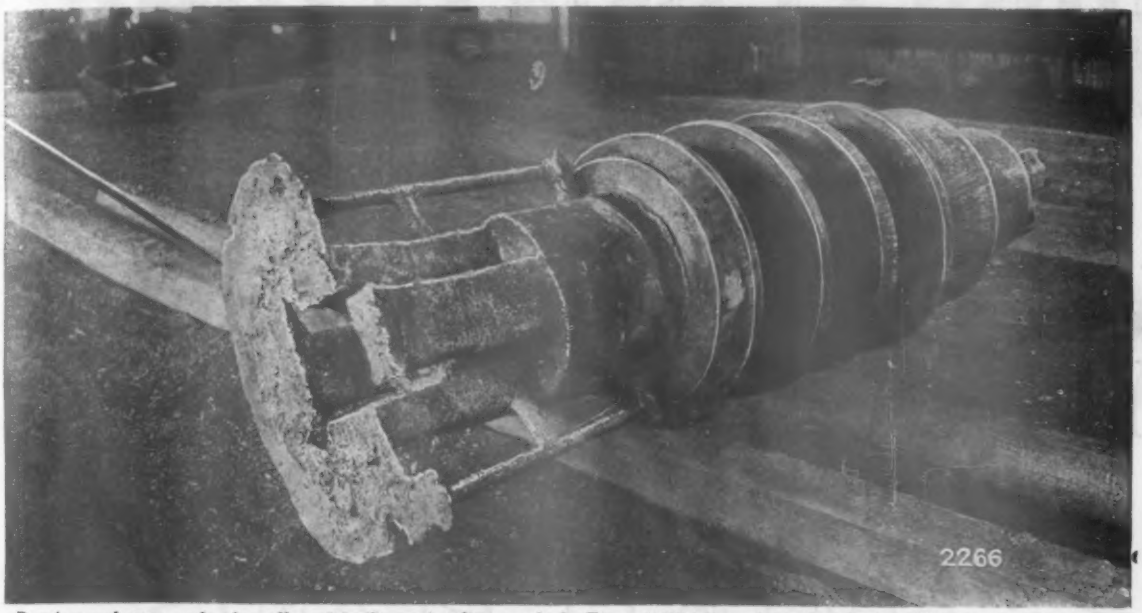

Bearing and worn pods of a roll neck built up simultaneously by Thermit Welding, American Rolling Mill Co., Middletown, O. Illustration shows pouring gates and risers before being removed.

A Rolling Mill, unlike the proverbial rolling stone, "gathers moss" only when it is rolling.

will keep **your** rolls rolling, just as it did in the case of the one illustrated herewith, and in many other cases too numerous to mention.

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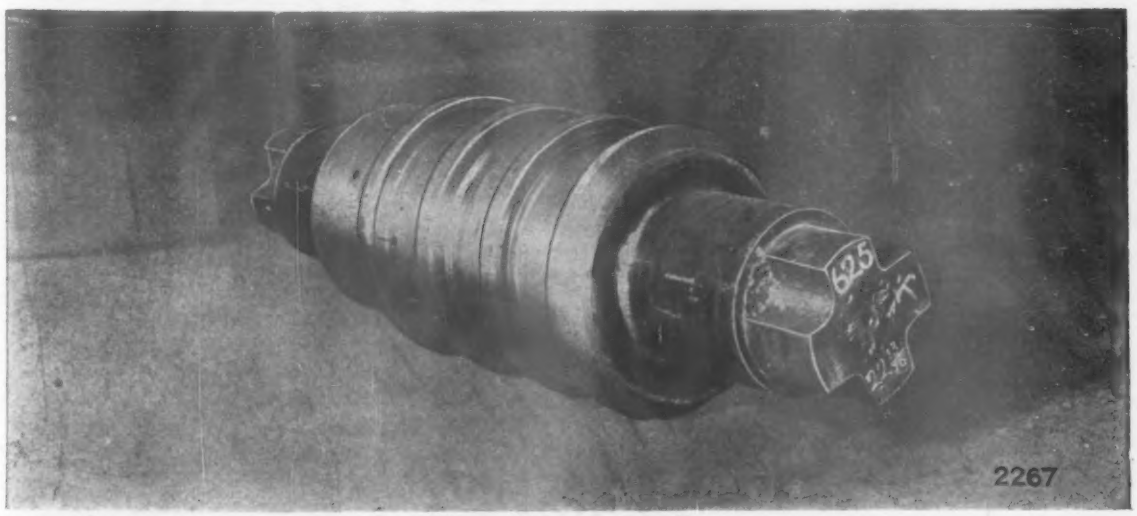

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BURDETT OXYGEN COMPANY

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ELECTROLYTIC OXYGEN and HYDROGEN - 99 1/2 % Pure

Service from the following BURDETT PLANTS

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Chattanooga, Tenn.
Cincinnati, Ohio
Pittsburgh, Pa.
Chester, Pa.
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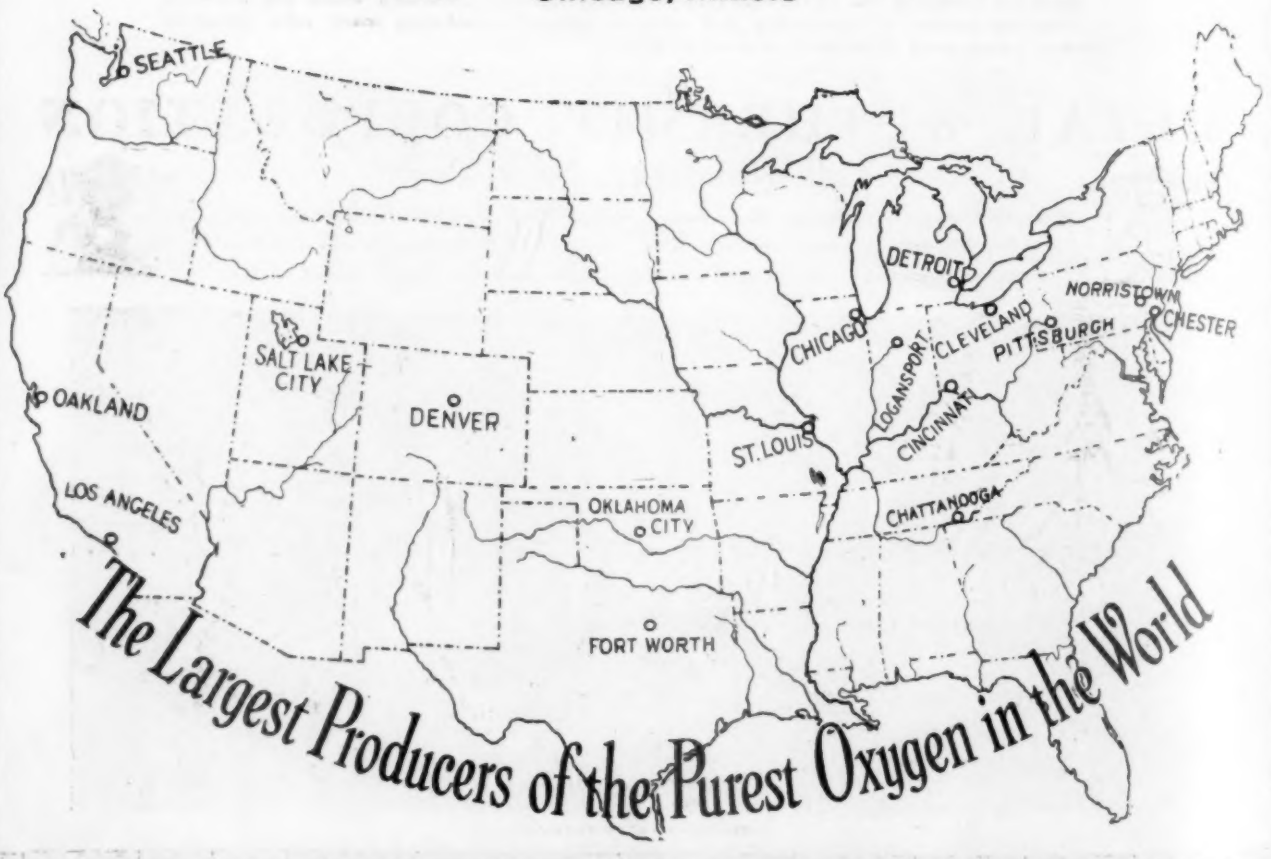

The Largest Producers of the Purest Oxygen in the World

"We guarantee to weld up your work at twice the speed and at one half the cost or you may return our welder for full credit."

This was the proposition we made one manufacturer.

We made good—he kept the welder.

Let us know what you are welding, and we might be able to make you a proposition which business judgment may force you to accept.

GIBB INSTRUMENT COMPANY

Factory and Offices: 348 Palmer Ave. E., DETROIT, MICH.

U.S. *Something New for Welders* **U.S.**

WELDERS MOULDING COMPOUND

Every Oxy-Acetylene and Electric Arc welder has undoubtedly felt the demand for a fire resisting compound which could be moulded into any desired shape. When building up metal around holes in castings, and where welding is necessary thru a machined part, such as a bearing, much time and machining can be saved in addition to making a neater appearing job by employing such a compound. Carbon blocks and rods have their field, but it is very limited. "Welder's Moulding Compound" can not only be used wherever carbon has been, but it has a much wider field. Moulds can be made for any missing lugs or parts and new ones cast that have all the appearance of having been machined. Aluminum parts may be "backed-up" preventing the collapse of the metal when heating.

For aligning broken sections, whether large or small, the usual shimming process may be forgotten and much time saved by using this compound as a cushion for the work. It can be used in hundreds of different ways, over and over again—it don't wear out. The wide awake welder will appreciate its true worth.

5 lb. Boxes with directions for use.....$2.50

Manufactured only by

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Fyber-Weld GOGGLES for Welders

Fitted with "Essentialite" Lenses

Frame is made entirely of vulcanized fibre, and in addition to being light in weight is a non-conductor of heat and electricity, is non-inflammable and infusible, is not affected by moisture or perspiration and is easily sterilized and kept sanitary. Has flexible leather center, ventilated side pieces and adjustable elastic headband.

Prices as follows:

No. 510, fitted Essentialite lenses, No. 4 shade, for cutting and cover glasses.....$3.00 pair
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Extra cover glasses in clear or amber tint..... .20 pair

"ESSENTIALITE" LENSES

To those of our patrons who are not thoroughly conversant with the real qualities and benefits of "Essentialite" lenses, we take pleasure in furnishing the following information. In placing the "Essentialite" before the trade, we have, after years of experimenting and research, succeeded in discovering the means of protecting the delicate organism of sight against the destructive Ultra Violet rays. We have demonstrated conclusively that with these lenses we vanquish the so-called "fatigue-weariness" and headaches caused by Ultra Violet and Infra Red rays.

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This Crew Is 100% Efficient

The men are of *uniform* strength. Any one of them can finish a job begun by any other.

This Crew Is Inefficient

It averages the same as that above, but the little fellow cannot finish the big man's job.

These Two Crews Show the Importance of Linde Uniformity

Any one of the millions of cylinders filled with Linde Oxygen must be interchangeable with any other produced by Linde.

For *uniformity* of oxygen is just as important to welders and cutters as is a high standard of quality.

Expert chemists are constantly at work in Linde laboratories to prevent the slightest deviation from the extreme high purity of Linde Oxygen.

Seventy-one Linde Distributing Stations make it possible to promptly supply welders and cutters everywhere with Linde Oxygen.

THE LINDE AIR PRODUCTS CO.

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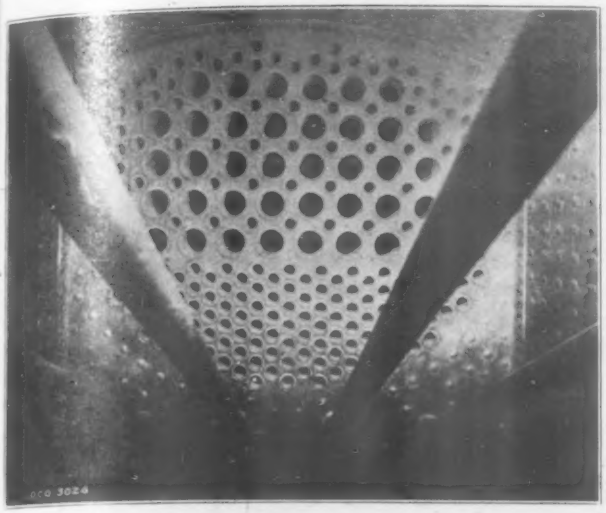
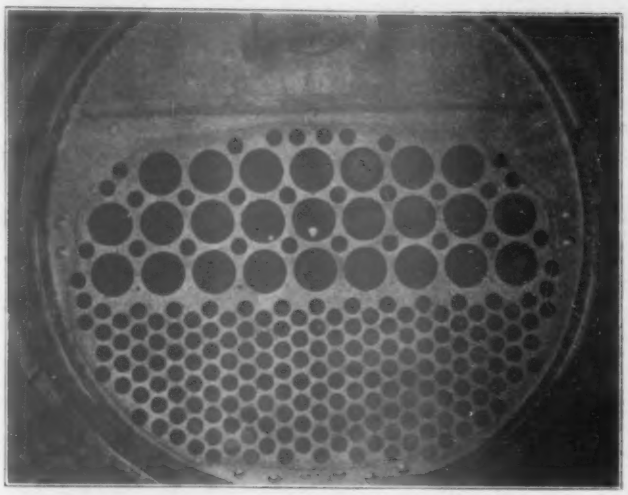
The Largest Producers of Oxygen in the World

L-511



Locomotive Flue Sheet Showing Flue Beads Welded to Back Sheet.



Front Tube Sheet of Locomotives Welded in by Arc Process.

Arc Welding in Steam Railroad Shops

By B. C. Tracey*

There has been so much already spoken of in connection with the subject of electric arc welding and the matter has been so frequently discussed that there remains but few new points of which to speak. It may be however, that the practice and development of the electric arc welding may be improved and advanced by setting forth the writer's own experience and methods of operation to the readers of *The Welding Engineer*, who no doubt will be able to offer valuable suggestions and criticisms.

There has been so much already spoken of and so frequently discussed in connection with the subject of arc welding, that there remains hardly any new points of which to speak; but telling of ones own experience and methods, to the readers of *The Welding Engineer* who no doubt will be able to criticize them, to my mind will go a long way towards increasing the efficiency of the arc.

Until recently, one of the greatest benefits derived from the use of the metallic electric welding process by the various railroads has been that of lengthening the life of flues and the elimination of possibly 90 per cent of flue failures. This result has been obtained by welding the flue beads to the back flue sheet. Many railroads have installed the electric welding machine for this purpose alone with varying success. Some of the roads have undoubtedly profited very greatly through the installation of these machines, while others have abandoned the practice of electric welding the flues, (that is, the beads to the back flue sheet), as well as welding other parts of the locomotives, claiming that the process is a failure. I think it may be fairly stated that the failures are due to one or more of the following causes:

*Power and Mining Engineering Dept., General Electric Co.

1.—Experimenting with a view to accomplishing a single purpose.

What is meant is, that many roads insert the flues in the flue sheet without the use of copper ferrules, and weld them to the sheet without further preparation of any kind. When such welds break, which is sure to occur, the operation is condemned. Other roads have belled the flues and have had them welded without further preparation with the same results.

Many similar instances could be cited, but those I have mentioned will serve the purpose I have in mind. I will speak further on about the proper way to prepare the flue sheet as well as the flue beads preparatory to welding.

2.—False economies in the purchase of welding electrodes.

It is very important that a clean (free from rust or annealing scale) metallic electrode rod be used and our experience has taught us that the hard unannealed bare electrode proves most successful for all general work.

The General Electric Co. has experimented extensively with the fluxed and covered electrodes. Results show that while some benefit may be obtained by using coated wire, as regards excluding oxygen and other foreign matter from the weld, nevertheless it is very important that the operator work or puddle out of the weld the foreign substance (coating). This coating can be of no value within the deposited material as each remaining particle of it means an oxide pocket as well as a weak point in the section; hence our recommendation to use a bare clean wire of an analysis to suit the work to be welded.

3.—Improper preparation of work before welding and lack of care following the operation.

This is a subject that could be lengthily discussed, but per-

Broken Cast Iron Locomotive Cylinder Showing Method of Preparation and Crack Repaired by the Bare Electrode.

haps a few rules would more definitely express the idea.

A. Under no circumstances should a set of flues be welded, that is, the beads to the back flue sheet until both the flue beads and back sheet are sand blasted thoroughly to clean them of dirt and grease.

B. The use of oil on flues or on the prosser rolls and beading

Interior View of Locomotive Fire Box Showing Overhead Weld Performed on Crown Sheet Patch.

tools should be prohibited.

C. No flues should be welded until they have been properly applied, that is, prossered well and beaded perfectly. All burrs shoud be smoothed off and the joint between the sheet and bead left clean.

D. All copper ferrules should be inserted at least 1/16 of an inch back of the surface of the flue head, otherwise, when they are rolled they will protrude from under the bead of the flue and after welding is started, make it almost impossible to produce an efficient weld. This alone is responsible for more electric welded flue failures than any other cause, as it is an established fact that the welding of copper to steel with the

Locomotive Flue Sheet Showing Flue Beads Welded to Sheet. Also Quarter Flue Sheet Welded.

electric arc except under certain conditions is not practicable

The flues, before welding, should be installed in the same manner as before welding was introduced, special attention being given to the above suggestions, particularly to preventing the copper ferrules from protruding beyond the edge of flue when beading down is begun.

The engine should then be fired up to a testing pressure or be given at least one trip over a division in order to give the flues a good setting to the head as well as to absorb the oil and grease from the head and back of the bead of flue. Then, the flue sheet should be sand blasted to procure a clean surface and insure a good adhesion of the electrode material, after which the welding should be performed in the following manner:

The weld is first started at the bottom center of flue or a little to the right, or left, then worked up on side to top center and then started on the opposite side working up and meeting at the top, lapping the weld at this point to overcome the blow and pin holes.

The method that has proven most successful, and which has been in use for over four years, after various other methods have been tried, is that the weld should be equally divided on

Locomotive Trailer Wheel with Flat Spot Built Up by Electric Arc Welding.

bead and flue head similar to sketch below.

Care should be exercised that the weld does not extend over the top of the bead to form a corner in which fire cracks will surely develop.

The following is a statement showing increased mileage obtained by one of the largest railroads on three of their largest divisions from welded flues compared with those that were not welded.

Engine Miles and Number of Failures

	Total Number of Miles Run	Number of Failures	Miles per Failure
Div. A	1,490,634	78	17,816
Div. B	1,223,613	47	26,034
Div. C	1,437,928	6	239,654

The data shown for Div. A was obtained before flue beads were welded to the back sheet.

The data shown for Div. B was obtained during first year in which the flues were welded to back head.

The data shown for Div. C was obtained during the second year of welding, showing beyond a doubt that a tremendous saving is effected when proper care and attention is given to this very important operation.

E. In the case *Re-Welding Old Flues.*

All the broken weld should be cut off, after which the flue should be thoroughly prossered and beaded; then a tool, similar to a beading tool, but with a rough flat heel should be used to cut off the dirt and make a clean surface on the flue bead adjacent to the head so as to make certain of a good weld.

Indiscriminate Selection of Operators

This is a point that requires a broad-minded view when referring to indiscriminate selection. It should not be taken as an undue reference to the employer. When there is a short-

Locomotive Trailer Wheel with Flat Spot Ready for Welding by Electric Arc Process.

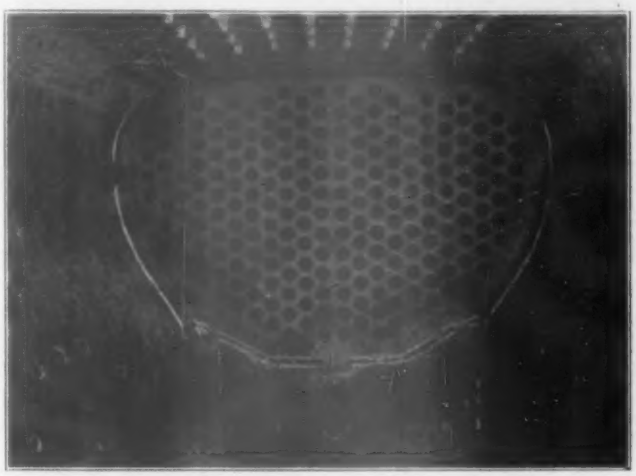
age of men the first thing that is done to select a man who is willing to attempt to weld. What is the result? You may place in a good efficient welding force, a man who, until he is thoroughly educated in the details, will be unreliable and will need careful watching. It was with this thought in mind that the General Electric Company established a school at its Schenectady plant to train operators for customers using their equipment. It is with pleasure that I state that some 244 men, during the period of the war, were educated for the United States Government, and since the signing of the armistice we have educated approximately 165 men for the various commercial industries.

The importance in selecting skilled men if electric welding is to be successful in their shops, can not be impressed too strongly upon the minds of the officers of the various railroads.

Fire Box Welding

This is a very important operation and if not properly performed, serious results will occur from failures.

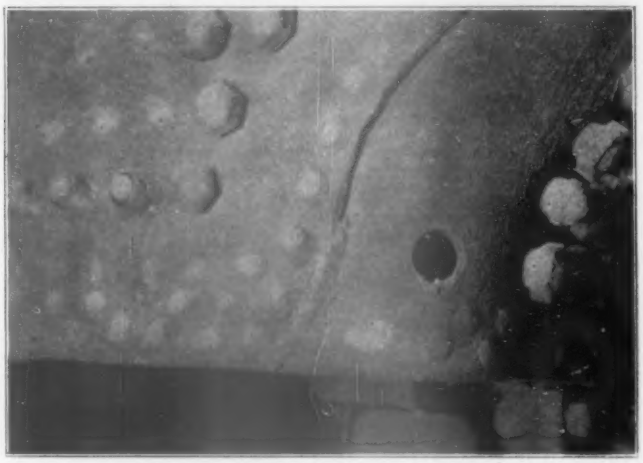
I have in mind the welding of complete locomotive fire boxes, the welding of half side sheets, crown sheets, as well as part flue heads. Here an operator must know the importance of



Interior of Locomotive Fire Box. Back Tube Sheet Ready for Welding by Arc Process.

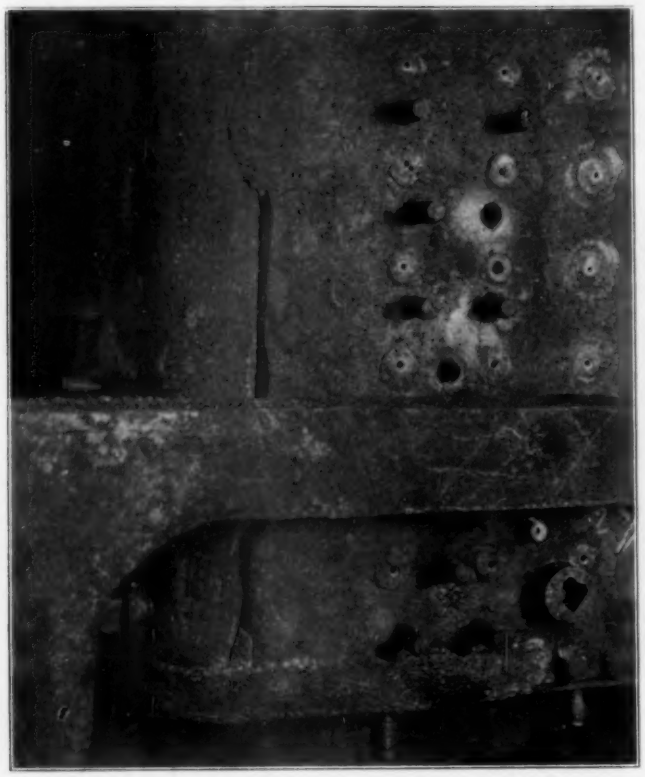
using the proper size electrode to correspond to the plate thickness as well as knowing the current values to be used with each operation. He should be taught that he can travel only at a certain rate of speed with a given amount of current. If he attempts to go faster than the allowed speed, he produces a weld that will be stretched and filled with numerous gas or air pockets which tend to weaken the section of the deposited metal. It is the writer's opinion that only the most expert operators in the shop should be allowed to do this class of work

A few operations that have effected quite a saving in a number of the railroad shops in the country today, are the repairing of locomotive fire boxes that have been shopped for second and third class repairs. One operation I have in mind is that of renewing the portion of the box that is defective, such as flue heads with a number of cracked bridges, and saturated



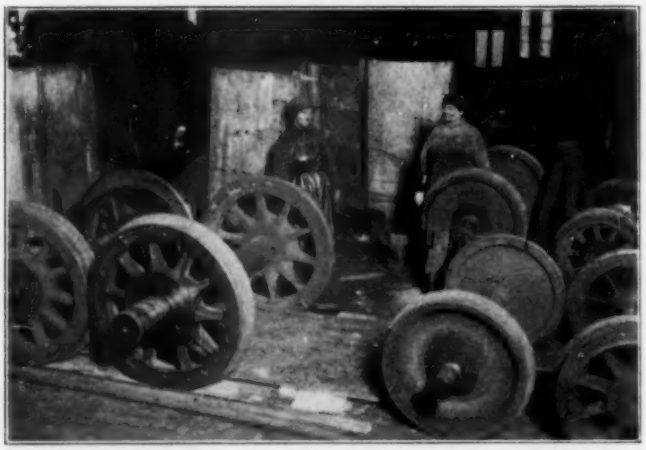
Corner Plates of Mud Ring Welded by Electric Arc Process.

type of locomotives that are being converted into the superheater type. In this case only the portion of the head is renewed that is necessary to take care of the large super-heater tubes, thereby saving the labor of flanging a new sheet riveted and applying patch bolts. All fire box welding is being performed with the bare electrode, and as stated previously, quite



Reinforcing Outside Sheet Corner of Mudring of Locomotive, Also Reinforcement of Sheet Where Rubbed by Spring Hangers.

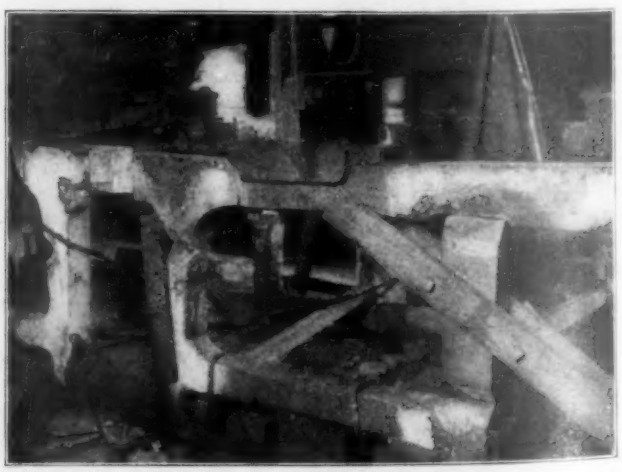
Steam and Electric Locomotive Wheels with Worn Flanges, Built Up by Electric Arc Welding.



Steam Locomotive Wheels. Car Wheels and Electric Locomotive Wheels with Worn Flanges Built Up by Electric Arc Welding.

Smoke Box Front with Studs Welded by Electric Arc Process.

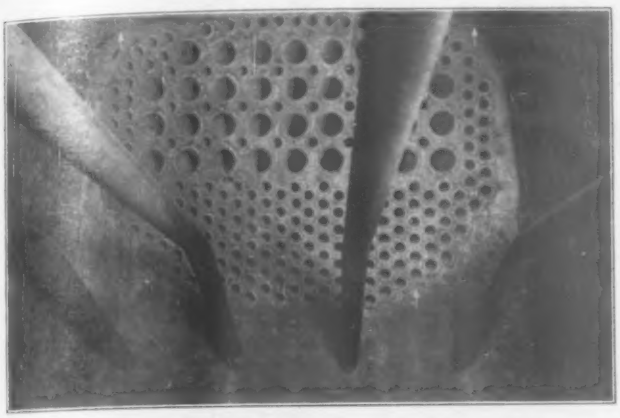
Left Side Frame of Locomotive. Break Partially Prepared for Welding. Rubbed Spots Built Up and Cracks Chipped Out and Welded. Electric Arc Process Used.



Right Side Frame of Locomotive with Breaks Prepared for Welding. Work Done with Locomotive Assembled.

a saving is being effected by the various users, some railroads not having a single failure in the three years' experience on this class of work. It can be readily seen how they have obtained increased service from their equipments.

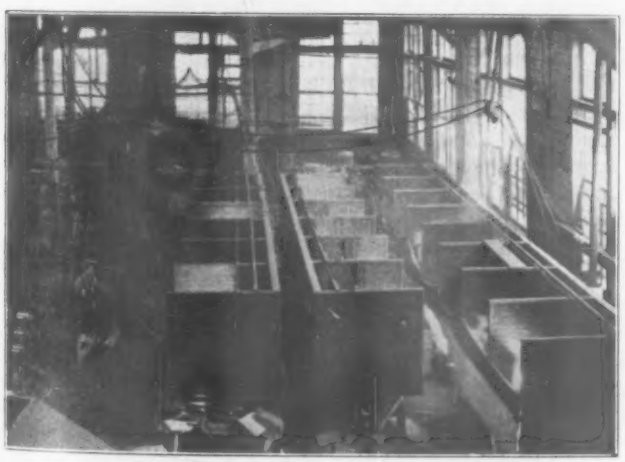
The writer has attended meetings wherein a number of districts, as well as local boiler inspectors have condemned the



Back Flue Sheet, Locomotive Fire Box. Tubes and Superheater Flue Beads Welded to Sheet. Patch Applied on Crown Sheet. Side Sheets and New Half Flue Welded in Place by Metallic Arc Welding.

practice of welding cracks in the top knuckle of the flue sheet, claiming that in 90 per cent of the cases the crack would let go after a short time in service. The writer has found that in the cases spoken of above, it is good practice, as well as serviceable, to remove the dome cap and "V" out the cracks from the *water space side*, filling in with the electric arc and then applying a light reinforcement on the fire box side, but in the case where a number of cracks run upwards from the flues in the knuckle of the flue sheet, it is a good practice to apply a patch the full width of the flue sheet, taking in the second row of flues.

Cracks in side sheets running from staybolt to staybolt should be chipped out "V" shape to an angle of 45 degrees clear through the sheet with a 3/16-inch opening. After welding, the metal applied should not be more than ⅛ of an inch thicker than the original sheet.



School for Electric Arc Welders Established by The Emergency Fleet Corporation at the plant of the General Electric Company.

Whenever welding cracks in side sheets, the welding should be continued until same is finished, thus to prevent the weld from cracking due to contraction. It is our recommendation that cracks in side sheets 15 inches or longer should never be welded, but defective metal should be removed and a patch set in and welded.

All patches welded in side sheets should either be oval or round and should be made ⅜ of an inch smaller than the hole. Before applying the patch, all old metal should be removed. Side sheets as well as patch should be beveled to an angle of 45 degrees. The patch should be set in position in the sheet with all staybolts applied, allowing a 3/16-inch opening all around patch. Weld should be started at the lower side and welded one-half way up, then started at lower opposite side and welded one-half way up. Then start again on the opposite side and continue the weld to the top. After patch is welded flush, it should have at least 3/16-inch reinforcement extending ⅛ of an inch from the outside edges of the bevel.

Welding of Outside and Inside Mud Ring Corners

The welding of the outside and inside seams of the mud ring corners is an operation that the writer believes is being somewhat slighted by a number of railroads, inasmuch as it is quite common to notice a locomotive in a terminal with steam leaking badly from around both the front and rear mud ring corners. This, I believe, could be readily overcome by applying electric welding to the seams. When welding mud ring corners the writer would suggest that they be thoroughly cleaned and all oil and grease removed. This either can be accomplished by sand blasting or with a roughing tool and then caulk before weld is started. The metal applied should extend at least 6 inches beyond the corner of the ring, as well as 6 inches up along the outside throat and back door sheet.

In the welding of broken mud rings, the writer has found it practicable to cut out a portion of the sheet near the fracture; "V" out the ring to a 90 degree angle, reinforcing about ⅜ of an inch and later welding the patch in the side sheet. Oftentimes it will be possible to reinforce from the underside. This requires an overhead operation which can be easily performed from the newer type of equipments.

Frame Welding

Until a few years ago, the welding of broken locomotive frames by the electric arc did not prove very successful, but after careful study of conditions to be met and also by improvements in design of welding equipment, it was found possible to weld these frames more successfully and at less cost by the electric arc, than by gas. Frames which are being electrically welded expand and contract less than frames which are being gas welded.

The writer has noted numerous cases, after completion of the weld by the electric arc, where frames which were framed varied less than 1/64th of an inch from their original dimensions.

In repairing broken frames the crack should be "V"'d from both sides, one-half way through to an angle of 45 degrees, leaving not less than a 3/16-inch opening. Iron plates should be placed on the bottom of frames to retain the metal when starting the weld. The joint should be partly filled in on one side of the frame, working from side to side, and then (providing only one man is working on the job) change to the opposite side of the frame and partly fill, etc. If two men are available for this operation, it has been found more successful to work them both at the same time, starting at opposite ends of the weld. This equalizes any heat strains that may be caused by the arc.

A CHICAGO SECTION

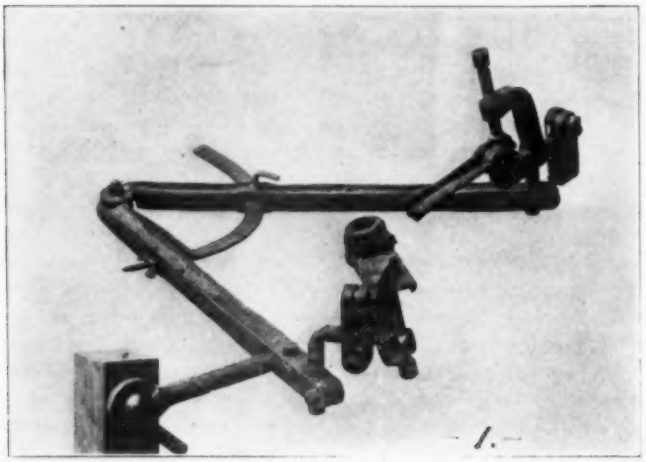
At a dinner in Chicago the latter part of March a few members of the welding trade met Comfort A. Adams, President of the American Welding Society, for the purpose of discussing the advisability of organizing a Chicago Chapter of the Society. It was the feeling of those present that such a Chapter should be organized and the movement will be launched in the very near future. Chapters will be organized in other localities as fast as possible.

A WELDERS CLAMP.

Editor:

In answer to your letter of recent date, I am sending you under separate covers, photos and cut of my welding clamp.

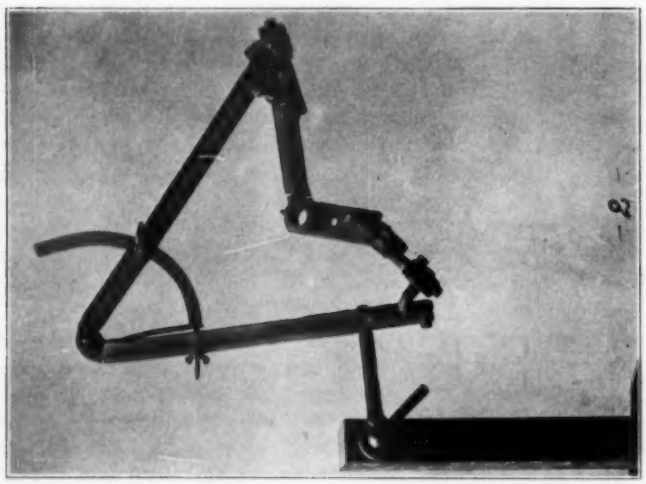
Fig. No. 1 shows the two parts of a broken casting fastened in the clamps, and Fig. No. 2 shows the parts brought in proper



alignment and tilted over in position most convenient for the metal to flow properly.

The pictures will show any welder the advantages secured by use of the clamp in the welding of small and medium sized castings regardless of their shape.

In welding a piece on a large casting one clamp may be fastened to the heavy part direct, doing away with the stand, and allowing the whole apparatus with the broken piece held in the other clamp, to hang on the casting.



I have done this several times but unfortunately have no pictures of it.

A. C. Treuthardt.

THE MAKING OF OXYGEN HYDROGEN GAS GENERATORS

Fifteen years is not a very long time in this fast moving age, and yet it is long enough to take the world back to the time when oxygen and hydrogen were little known industrially and commercially in this country. Today these important gases have revolutionized manufacturing. Repair work has been put on a different plane. Salvaging has become a dignified and profitable occupation. In fact, the industrial applications of oxygen and hydrogen are so numerous and diverse that its possible future importance can only be measured by its rapid development in the past few years.

No method for obtaining oxygen and hydrogen has proven more satisfactory than that of decomposing water by means of the electric current into its component parts. This is one of the oldest electric-chemical processes and engineers have given their constant efforts toward the perfection of such apparatus.

Beginning back in 1909 Mr. Levin, inventor of the Levin cell, spent a year and a half in Europe in the investigation of the electrolytic cells and special application of the oxygen-hydrogen flame, and the Levin cell is the outcome of long engineering experience. Mr. Levin has been connected with international developments of the oxygen-hydrogen gas generator.

The Electrolabs Company and the Electrolytic Oxy-Hydrogen Laboratories are devoted exclusively to the oxy-hydrogen industry, the former in the capacity of manufacturing and sales organization, and the latter of research and development for the apparatus and application of oxygen and hydrogen gases.

The research and development have resulted in extensive patents covering the pure science phase, as well as the manufacturing aspects of the industry. Their research in over voltage and other refinements has resulted in the first basic patents in the art.

The generating units are filled with a strong caustic solution through which the direct electric current is permitted to pass. The oxygen is formed in the oxygen compartments on the positive pole and the hydrogen is formed in the hydrogen compartments on the negative pole. The gases from each are collected in independent manifolds or offtake pipes and conserved in regulation gas holders.

The cells are built in two sizes—Type "A" and Type "B." Both cells are made exactly alike except that they are of different dimensions. The production of gases in each type is directly proportional to the number of amperes passing through it. Each cell is of the unit type. It is small and compact, also simple in construction, being enclosed in stamped sheet metal sections.

They have found American Ingot Iron Sheets—as a result of very extended tests—to be by far the most appropriate material for the construction of their apparatus.

The electrical problems are best taken care of by Ingot iron because of the exceptionally high electrical conductivity of this metal.

THE STANDARD ELECTRIC WELDING CO.

The Standard Electric Welding Co., of Philadelphia, started in business September, 1919, in a small shop in Kensington, the heart of industrial Philadelphia. Through the superior character of their work and service, they have developed a business of considerable amount and have recently moved to larger quarters at 1939-41 E. Sergeant Street at Emerald Street, in the same locality. "Proper and Prompt Service" has been their motto and they are now leaders in the welding business in Philadelphia and vicinity.

The individual members of the company are A. Schroeder and George L. Bright. Mr. Schroeder is a man of considerable experience, especially in the metals and textile trades, having been engaged in the building of machinery for a number of years. He has thoroughly studied the electric welding proposition and is fully familiar with the same. Mr. Bright has been engaged in the electric welding for a period of over ten years in the various industries where welding is employed, such as railroad shops, ship yards, foundries and machine shops, etc. He has operated practically all welding apparatus for both D. C. and A. C. conditions. As demonstrator, careful and skillful operator, he has gained an enviable reputation.

The company is doing the most difficult work and has been very successful with cast iron. Their new shop is very comfortably equipped to give service properly and promptly in the same or at the plants of the customer.

GENERAL WELDING & EQUIPMENT CO.

GWEC

107 MASS. AVE. BOSTON, MASS.

EQUIPMENTS FOR WELDING AND CUTTING

PASSED BY THE UNDERWRITERS LABORATORIES CHICAGO, ILL.

TESTED BY THE BUREAU OF STANDARDS WASHINGTON, D. C.

WE ARE NOT HANDICAPPED BY BEING THE OLDEST CONCERN IN THIS LINE OF BUSINESS, NEITHER ARE WE THE LARGEST, BUT WITHIN A FEW YEARS WE HAVE BUILT UP A REPUTATION SECOND TO NONE FOR QUALITY AND SIMPLICITY IN CONSTRUCTION, FOR ECONOMY IN OPERATION, FOR REASONABLE PRICES AND FOR THE CONSIDERATE SERVICE WE FOLLOW UP WITH.

OXY-ACETYLENE WELDING OF PIPE MAINS†

By Prof. Alfred S. Kinsey*

One of the most serviceable applications of the oxy-acetylene process to modern construction is the welding of pipe joints, especially on large size pipe lines for gas, air, oil, water and steam.

An illustration of this may be found in the new pipe line recently laid near Philadelphia, under the supervision of the Engineering Service Department of the Air Reduction Sales Co., for the Counties Gas & Electric Co., a company managed by the United States Improvement Co., of Philadelphia. The line, see Figure 1, is of standard 12 inch and 16 inch steel pipe, being double-piped for three miles and single-piped for five miles. It is to be used to supply by-product gas from the Rainey-Wood Coke Ovens at Bridgeport, Pa., for illumination and heating throughout the territory of Montgomery and Delaware Counties, Pa. The pipe line crosses the Schuylkill River at Norristown, Pa.

Special Fittings Being Welded to Pipe Valve.

Types of Joints

There are three methods used in the welding of heavy pipe mains, i. e. the ditch joint, the stationary joint and the turning joint. The first is accomplished by welding down in the ditch without turning the pipe, the second by doing the welding at the top of the trench without turning and the third by welding the joints at the top of the ditch and turning the pipe to meet the convenience of the welder. The last mentioned method was employed most of the time on the Philadelphia job because it was found to be the most efficient and economical.

The joints were made up as follows: The pipe has been sent with its ends unthreaded and beveled at 45 degrees for about two-thirds of the thickness of the wall. The bottom of the bevel, however, was so blunt that it proved to be the cause of some poor welds. The welders found it difficult to get the metal melted all the way through. The beveling was therefore carried all the way down by the cutting torch and the bottom of the vee made sharp. Torch beveling requires about seven minutes for 12 inch standard pipe and nine minutes for 16 inch standard pipe for each end.

Figure 3 illustrates the ends of the pipe as received, which is also too frequently the type of beveling done for other steel welds, ends so blunt that separation is necessary. Even then a good weld is hardly to be expected because of the tendency of the metal to melt at the top of the blunt ends, a and b, Fig. 4, and flow down between them without proper fusion at c and d. This may easily be seen in some steel welds by breaking them. Pipe ends should be beveled at 45 degrees to a sharp edge at the bottom as shown in Fig. 5. Some welders have omitted the beveling and attempted to weld pipe ends by forcing the flame through the pool of liquid steel until the joint has been completely fused. This usually results in the metal being over-

Welded Section Before Being Lowered.

heated and made coarse and granular as shown in Fig. 6. Such a weld is in many cases not half as strong as it would have been if properly beveled. Beveling pays for any thickness over say ¼ inch.

Another piece of deceptive welding too frequently practiced by some welders is to try to reinforce a joint by overlapping the filler of the vee upon the hard surface of the ends of the job, as shown in Fig. 7. The areas a to b and c to d are usually only stuck on, not fused, and the reinforcement is valueless. Figure 5 gives the correct appliaction of the filler when added strength is desired.

Welding the Joints

After the ends were properly beveled, the twenty-foot lengths of pipe at Philadelphia were aligned and butted closely together. Then they were tack-welded at four equidistant points around the circumference of the joint, to prevent throwing the pipes out of alignment during welding. It was not necessary to turn the pipe for this tack-welding. One welder worked at a joint and as the welding progressed, laborers turned the pipe with chain tongs to make the joint readily accessible to the welder. The filler rod and pipe ends were thoroughly fused and the vee filled to about one-eighth inch above the surface of the pipe.

†One of the important uses of welding is in the construction of pipe systems with the joints welded together instead of being made up by fittings. Professor Kinsey gives an interesting illustration of this in the new pipe line which has just been completed near Philadelphia.

*Advisory Service Engineer, Air Reduction Co., New York.

Keep the Guess-Work Out of Welding

Go out into your shop, light up an oxy-acetylene torch and adjust your valves until you have a neutral or true welding flame. Hand the torch to any welder and ask him—"How is that for a correct flame?" Then you make a bet that he will change your adjustment, and you will win 498 times out of 500. We know. We've tried it much oftener than 500 times.

It isn't just natural contrariness that makes every welder change every other man's flame adjustment. It is because men in different shops are taught different adjustments—taught to use different pressure ratios, and not two in a hundred know *why* they use certain pressures. Lots of foremen, lots of superintendents, lots of engineers don't know why certain pressures are specified for tips of certain sizes.

Pressure has but one function—to give the gases sufficient velocity to prevent backfiring. Pressure has nothing to do with a correct flame or a correct weld. Without a correct *mixture* there can be no correct flame—no correct weld, and there has never been any reliable, uniform guide to a correct mixture. There has never been *any* guide except a man's visual judgment, and you can prove to yourself in two minutes that no two men have the same visual judgment. You can prove that ten men on identical work, with identical torches and tips are likely to have ten different pressure ratios and ten different gas mixtures, and that means ten different qualities of welds.

This is not said in criticism of the welder. It is a wonder he does even as well as he does, with no guide except his eye, often seriously affected by the bright rays from his flame, but the real wonder is that the seriousness of this matter of mixture has not struck home to every welding shop official, because every cubic foot of oxygen you use in excess of your combustible gas to obtain a neutral flame is not only wasted but is detrimental to your welds.

The answer is a Hydrex Flow Indicator. Write for complete information about this wonderful and efficient instrument.

Hydrex Engineering Corporation

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The welding rod used was of soft steel, one-quarter inch in diameter.

About fifteen lengths (300 feet) of pipe were welded before the section was lowered into the trench.

As much of the welding as possible was performed at the top of the trench, but some of it had to be welded down in the ditch, as shown in Fig. 8. (This is a good illustration of the portability of the welding apparatus.) However, in the welding of big pipe mains care should be taken to avoid the use of the ditch joint or the stationary joint. The turning joint can be made the quickest and will be the strongest and most economical.

Cost of Welding

The relative cost of welding by these different methods should be about as follows, with labor and welding materials at the prevailing rates:

Turning joint	1
Stationary joint	1.3
Ditch joint	1.6

Leakage Tests

Leakage tests of the joints were made on the Philadelphia line after from ten to fifteen 20-foot lengths of the pipe had been welded in one continuous run. The two ends of the run, usually about 300 feet apart, were sealed with a rubber gasket and a ½-inch steel plate clamped tightly over it. In order to prevent the clamp from slipping and the head from blowing off, small lugs were welded about eight inches from the end of the pipe, see Fig. 9. The clamp was made of ⅜x3-inch angle iron, and shaped to fit the pipe, see Fig. 10. In some cases sheet steel caps have been welded on one end of a run instead of using the clamp, the end of the pipe containing the cap having finally to be cut off with the torch. The clamps are more practicable however.

Welded T Section.

An air pressure of 30 lbs. per square inch was then pumped into the whole run, see Fig. 11, and the joints brushed over with soap water to reveal any leaks. This was all done at the top of the ditch. Very few leaks developed, most of the 300-foot runs being entirely free of them. In a few instances from one to three leaks were found in a run, and these could usually be traced to welders working without wind-breaks on a windy day, or to laminated and porous pipe. The holes were easily closed with the torch.

After a run had been lowered into the ditch it was welded to an adjacent run. This necessitated a pocket being excavated under the joint in which the welder could work and reach the underside of the weld. These bottom ditch joints were tested in the same manner as those at the top of the ditch, the air pressure being pumped up throughout the combined length of runs to a valve or some other stop fitting. The pressure was left on over night as a final assurance of the tightness of all the joints.

On some jobs the tightness of the welded joints have been tested by first doing all of the welding at the top of the ditch, and then deliberately rolling the pipe into the ditch. This seems an unnecessarily severe strain to put on the welds.

Advantages of Welding Pipe

Th oxy-acetylene welding of large pipe has reached such a degree of success that it now is generally recognized to be a practical and efficient way of making such joints, especially for low pressure service. The advantages obtained may briefly be summarized as follows:

1. Strength of Joint. The welded joint may be made practically as strong as the pipe itself. In fact, by increasing the thickness of the weld as is common practice, it may be made stronger than the pipe wall, depending on the skill and care of the welder. It may be of value to call attention to the fact that all steel pipe excepting drawn tubing, has a butt or scarf weld, made by plasticity, along its whole length. It is reasonable to assume therefore that most oxy-acetylene end welds made in pipe by fusion will be stronger than the long side welds made by plasticity.

2. Tightness of Joint. The welded joint can be made as tight and free from leakage due to porousness or edge fusion as any part of the pipe wall. Under pressure tests it has been found that ordinary steel pipe is just as apt to show porousness at some unexpected spot in the wall as in an oxy-acetylene weld. When once made tight by the oxy-acetylene weld the joint will stay tight permanently.

Two Welded Sections Ready to Be Lowered.

3. Relative Cost. It has been found that the oxy-acetylene welded pipe joints cost from 25 to 50 per cent less than joints made of threaded pipe ends and couplings. To this also should be added the reduced cost of maintenance of the joints and elimination of loss of pressure common to leaky threaded joints.

4. Special Connections. Branches may be welded to mains at any angle required, while if standard fittings are used they limit the angularity of the branches. Odd size reducers and special fittings may easily be made by the oxy-acetylene welding torch, and frequently this is done on the job as the work progresses and unexpected parts are required. Figure 12 is a good example of this work.

Pipe welding, of course, is not confined to large size pipe. The practice of oxy-acetylene welding small pipe has grown so rapidly that it is possible to find the process being extensively used on ammonia lines in refrigeration plants, steam lines, on hydraulic and compressed air lines, on piping to be placed inside of heavy masonry, on steam boiler flues, condensor tubes, in apartment and office buildings, and practically wherever a permanent, leakless, flexible, continuous joint is desired.

The scope of application of oxy-acetylene welding is to all kinds of metal. With this torch it is possible to weld pipe of steel, wrought iron, cast iron, brass, copper and aluminum. Leaky and damaged pipe fittings may be repaired and broken flanges built up.

(Continued on Page 38)

THE SIGNIFICANCE TO *YOU* OF THE MEMBERSHIP OF

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2. To subscribe to and work for truth and honesty in all departments.

To eliminate, in so far as possible, his personal opinions from his news columns, but to be a leader of thought in his editorial columns, and to make his criticisms constructive.

4. To refuse to publish "puffs," free reading notices or paid "write-ups"; to keep his reading columns independent of advertising considerations, and to measure all news by this standard: "Is it real news?"

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WELDING AND C

An Anniversar

Two years ago—in June, 1918—the REGO line of welding and cutting a paratus was announced through the columns of THE WELDING ENGINEER.

The claims made for REGO torches were rather startling to the welder versed injector and semi-injector torches. We promised:

Freedom from flashbacks, even with the tip plunged into molten metal, hea red hot, drawn over wooden surfaces or placed directly on a fire brick.

A torch which **did not use the acetylene under a higher pressure** than posit **pressure types;** yet reduced the oxygen to about **one-fourth** that used by these typ For instance, the REGO No. 10 tip—drill size No. 29—uses only **nine pounds ace lene pressure** and **seven and one-half pounds of oxygen and will operate** perfectly **half these pressures.**

A principle in torch construction which produced a **soft welding** flame, in wh **no excess oxygen** detrimental to successful welding, could be present and wh would result in a decided saving of oxygen.

WE HAVE KEPT THE FAITH

Two years' use of REGO torches—thousands sold to the largest industrial c cerns, railroads, shipyards, Navy Yards, and to the practical welding men of United States and Canada—**prove we have fulfilled our promises.** REGO torches exactly what we claim for them.

The technical principle of the REGO torch whereby the flashback is eliminated equal volumes of oxygen and acetylene are used, **is of the utmost simplicity.** Prio its discovery, the reasons given for a flashback in the text books of torch manufac ers, varied from "flying sparks passing into the interior of the torch" to "the acetyl igniting due to overheating."

Welders who use the REGO know the principle is correct. Engineers who st it admit that our claims are true. **Any person familiar with the use of the oxy-acetyl process can understand why this principle is correct in ten minutes' study of exis types of torches.**

The REGO principle was invented and developed by The Bastian-Blessing org zation. This organization has had twelve years' experience in torch construction over twenty years in regulator building. **We know**—we don't guess—how to build gas equipment.

C. L. Bastian, President

John S. Nash, Vice-President

L. G. Blessing, Treas. and Gen. M

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One of the things we are particularly proud of is that **no fundamental change** s been made in the construction of any part of the REGO line since it was placed on e market two years ago. Repair parts for today's torches fit the torches made and d in June, 1918.

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Since June, 1918, there has hardly been a month when deliveries have not been fficult; we've always been just a little bit behind on orders.

Recently we have added practically 50,000 square feet of floor space to our manu-cturing facilities and very shortly we think our deliveries will improve and **we will e in a position to take on new business.**

If you use welding or cutting equipment, you'll want to look into the merits of e REGO line. **It has real merits**—not the kind usually written about by an advertis-g man.

If you can sell welding and cutting units, torches and regulators, the REGO **de-ands your careful consideration.** We have a real proposition for honest-to-goodness, ell-posted welding apparatus men who are able to carry some stock and who have e enthusiasm necessary to properly handle a line like REGO.

ABOUT OURSELVES

All of us at the factory here are mighty interested in the REGO line. Two years o some of us didn't know just how good it was; but our record of sales in that time, e letters we daily receive, our distributors' talks with us—these have all convinced us at we have the best line of welding and cutting equipment in the world. From the esident down, all of us are trying in some way to make the REGO line **better,** to ild more **business,** get more **distributors** and to **SATISFY THE USER** by giving m the finest equipment possible to buy.

ABOUT YOU

Our new issue of catalogues will be off the press about the first of the month—ere are just a few of the last edition left. If you don't know about REGO, you're issing something. It would be a good idea to start right now getting acquainted.

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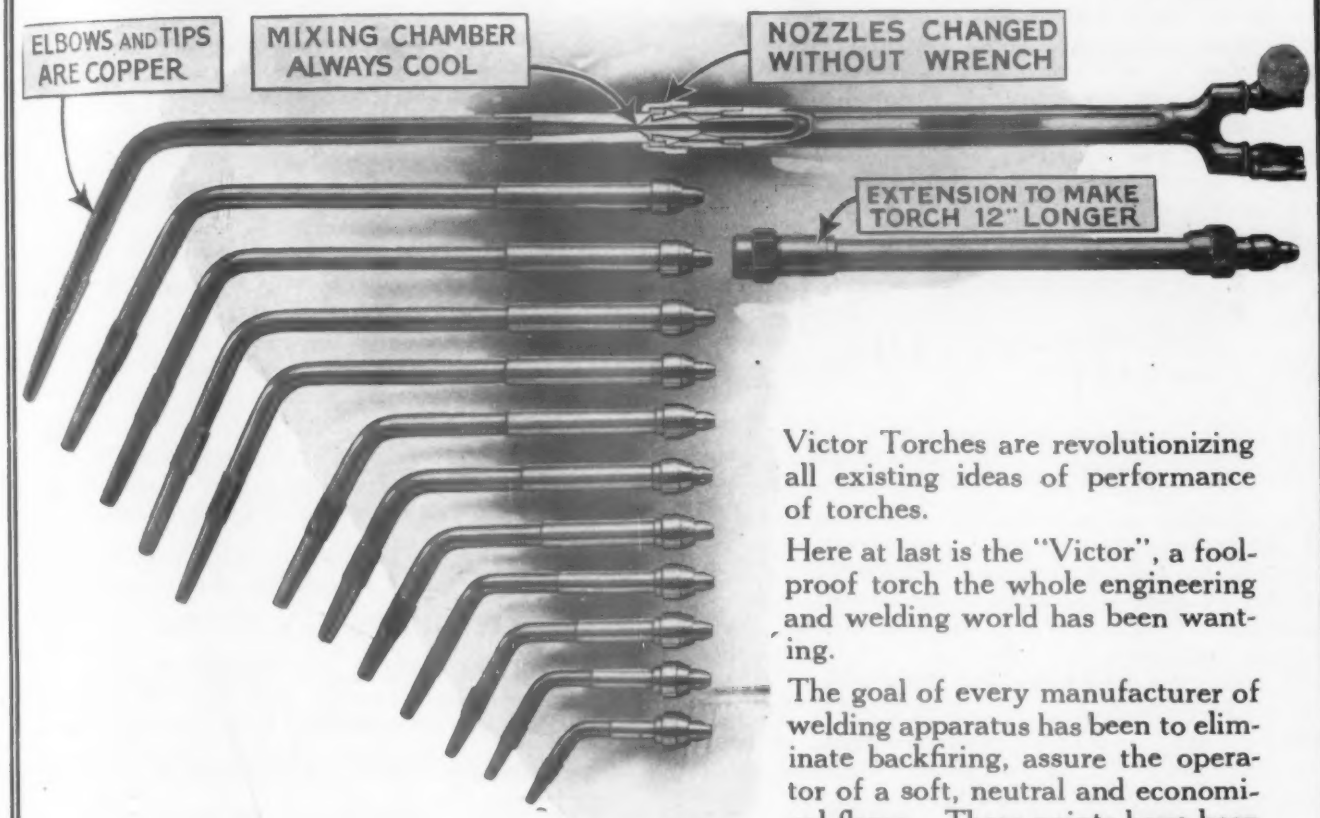
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The goal of every manufacturer of welding apparatus has been to eliminate backfiring, assure the operator of a soft, neutral and economical flame. These points have been accomplished at a single stroke with the new "Victor" torch (covered by U. S. Patents).

Victor Torches stand alone in speedy performance of work and economy of gases, which is proven every day by the largest users of apparatus, showing a saving of 31% in gases and labor and on heavy work up to a 50% saving. You will say—How is this possible? Because the Victor Torch mixes its gases properly, and allows the flame to be increased to unlimited power without blowing. And when needed the flame can be reduced to a tiny tongue of fire.

Victor Torches positively do not backfire under any condition or pressures of gases, which is most important as it is almost impossible to hold gas pressures uniform on regulators, especially if the apparatus is in steady and severe use.

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(Continued From Page 32)

The cutting of steel and wrought iron pipe also may be accomplished with an oxy-acetylene cutting torch. It is of special advantage in making nipples, cutting holes in pipe for branches, beveling ends of pipe for welding, etc.

Welding School for Pipe Fitters

The general demand for the welding and cutting of pipe has caused many pipe fitters to seek a training in the use of the oxy-acetylene torches. The writer was requested a few months ago to organize a special pipe-welding class at the Twenty-third Street Y. M. C. A., New York City. The men were all experienced pipe fitters which, of course, enabled them to readily acquire the proper handling of the torch. They were fine examples of ambitious, intelligent mechanics, and it was interesting to note how quickly they learned to make good welds. If this practice is followed, that of making pipe welders of trained pipe fitters, it would seem to go far towards guaranteeing welded pipe joints of satisfactory efficiency. The work performed by the class covered the welding of pipe made of all the common metals, branch welding, repairs of fittings, making special fittings, welding radiator sections, cutting pipe, etc. The men were given lectures on the metallurgy and principles of the work for the first forty minutes each evening, and the next eighty minutes were spent in the welding shop learning how to operate the torches.

WEAKNESSES OF WELDED TANKS*

By John S. Watts

The manufacturers of rectangular-welded tanks are apparently following the same designs for the staying as were used when the tanks were riveted. The result is that the tanks fail by opening the welds at the corners, which soon commence to leak and, not being repairable, have to be scrapped. This gives the welded tank a bad reputation—which it does not deserve, the fault being entirely with the weakness of the bracing.

The weld comes at the point of greatest flexure and strain in the plate, and so the tanks, as they are ordinarily braced, "breathe" to a greater or less extent when the tank is emptied or filled. The strain which this breathing puts on the welded joint can be seen by observing the movement of the side and bottom plates of such a tank in service.

It may be easily understood from such observations why no welded joint will stand the racking strains occurring at the corners and why the welds give way here and start to leak.

Unfortunately, there is no practicable way of repairing a welded joint, and so the whole tank must be scrapped.

The old style tanks with riveted joints were made with an angle bar in the corners, and consequently, the deflection of the plate had no serious effect. For this reason the number and fit of the braces was not of such vital importance as it is in the welded work.

A welded tank, however, with the same bracing as was sufficient for a riveted tank will certainly prove defective.

The stay is simply a round bar with the ends bent over and made to drop loosely into the holes in the angle bars. Before this stay can take its load, the side of the tank has to bulge outward until the slack is taken up in the holes. Even then the plate will bulge still more between the angle bars, as the span horizontally across the tank is too great, and the stays, being usually spaced about 30 inches apart vertically, support only a narrow strip of plate horizontally across the tank.

*The Boiler Maker.

This deflection may be observed in any tank undergoing test, so it is not necessary to prove that such a deflection exists by calculating the amount.

This defect may be remedied by fitting a sufficient number of solidly riveted stay bars to hold the plate from deflecting too much.

My opinion is that the plate must be supported by angle bars placed both horizontally and vertically, and the pitch of these angle bars must be such that the stress in the plate, calculated as a beam 1 inch wide and fixed at the ends, whose span is the distance center to center of the angles, must be limited to 16,000 pounds per square inch.

The plate is then actually a square plate fixed around the edges. In these thin plates with a relatively long span the horizontal strip in the center of the square does not derive much, if any, support from the angle bars above and below.

Calculating for a strip 1 inch wide, we have from the formulae for beams fixed at the ends and uniformly loaded:

$$W = \frac{12 \times f \times z}{l},$$

where W = load in pounds = $p \times l$, where p = pressure per square inch.

f = stress = 16,000 pounds.

z = modulus of section = $\frac{t^2}{6}$, where t = thickness of plate.

l = pitch of angle bar stays.

Substituting in above formula, we have:

$$p \times l = \frac{12 \times 16{,}000 \times \frac{t^2}{6}}{l}$$

$$p \times l^2 = \frac{12 \times 16{,}000 \times t^2}{6}$$

$$l^2 = \frac{2 \times 16{,}000 \times t^2}{p}$$

$$= \frac{32{,}000 \times t^2}{p}$$

$$\frac{32{,}000 \times t^2}{p}$$

$$l = \frac{32{,}000}{p} \times t.$$

$$=$$

The angle bars should be riveted to the plate with rivets not over 4 inches pitch, and of a diameter sufficient to carry the load due to the pressure at 7,000 pounds stress.

The angle bars need not be large, and can be easily determined by calculating their strength as beams uniformly loaded and fixed at the ends.

The cross stays should be flat bars or angles, riveted to the angles, fitting a stay at the intersection of each horizontal and vertical angle.

Calculation will show that these angle stiffeners and cross stays need not be very heavy to carry the load, the main point to watch being to see that they are tightly riveted.

RESCUE BY ACETYLENE FLAME.

A gang of seven men that took refuge in a compartment of the hold of the Ward Line S. S. "Guantanamo" in Brooklyn recently, to escape from ammonia fumes coming from a tank, the head of which had blown out, were rescued through the quick wit of another gang engaged on a job of welding. The welders were at work on a barge alongside the same pier when the news of the accident reached them. The seven men were part of a crew of twenty-five engaged on the repair of a

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in the Science of Preheating and Welding demands the attention of every Welder.

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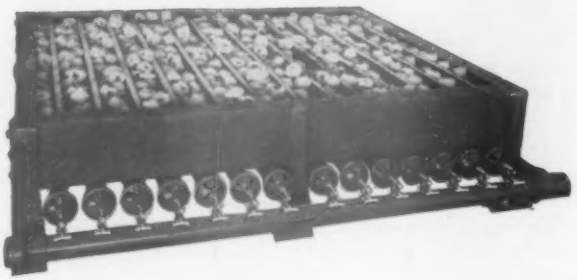

We are the only manufacturers of a Preheater that will preheat with 100% efficiency, without the time of setting up torches or making fires, and a preheater that is always ready for duty, with a greater saving of fuel than any other known method on the market today.

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The **WIEDERWAX PREHEATER,** if used, will increase production from 15% to 25%.

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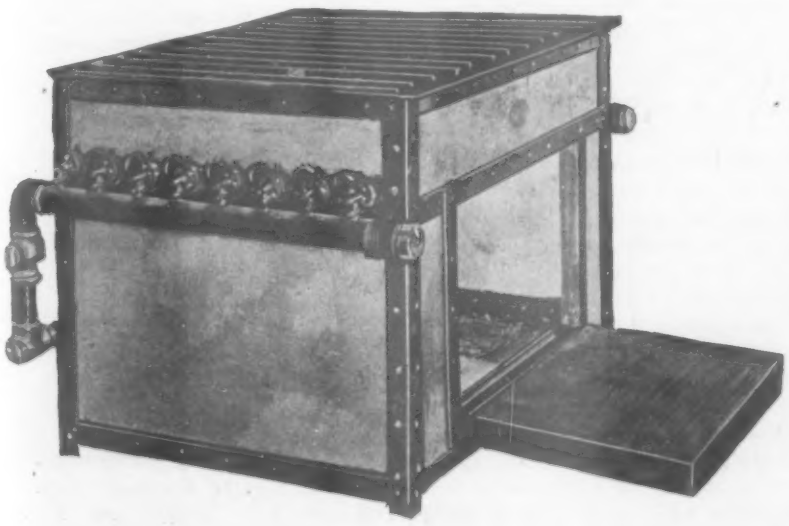

Full particulars will be gladly furnished by writing for same

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Atlantic City, New Jersey

condenser. Under too great pressure, an ammonia tank in the engine room gave way, flooding the room in which the men were working. All of the men were able to scramble to safety to the hatchways and upper deck.

Cut off from exit, the seven returned to a compartment far down in the hold, from which they signalled their location by rapping loudly on the plates with their hammers. Their predicament was grave, as the fumes of ammonia, filtering through the crevices, slowly filled the room and made breathing more and more difficult.

The welders rose to the situation by cutting a hole through

The welders rose to the situation by cutting a hole through the compartment where the men were imprisoned and thrusting down a compressed oxygen pipe line used on their own job. This not only served to blow away the ammonia fumes from the men, but supplied them with comparatively pure air to breathe for the period of half an hour. Meantime the fire department had been called, and Battalion Chief James Hefferman and his chauffeur, Martin McNamara, who tied vinegar handkerchiefs over their faces, were lowered into the hole by the welders.

They opened the compartment door, and after three trips, got all seven men to safety, though the latter were all temporarily blinded from the effects of the fumes, and were so weak that they could hardly stand. The heroism of the firemen, and the resourcefulness of the welders were the subject of considerable comment in the press.—Canadian Welding Engineer.

THE DISPOSAL OF OLD COMPRESSED-GAS CYLINDERS

Some time ago a rather unusual incident occurred in a manufacturing plant says *The Traveler's Standard*, showing the necessity of handling with great care cylinders or tanks used as containers for compressed gases. In the plant referred to, large quantities of steel and iron scrap of the most miscellaneous character are melted in an open-hearth furnace and the metal thus obtained forms the basis for the manufactured products of the plant. At one time a compressed-gas cylinder was received with other scrap, and upon being thrown into the furnace it exploded and blew the entire top off the furnace. This experience was remembered, and when a similar gas cylinder was received on another occasion, it was taken off the charging buggy and thrown on the charging floor. Several hours later one of the employes, observing that the valve on the cylinder was still in place, secured a wrench and opened the valve. The cylinder had been filled with chlorine, and enough of the gas was released to cause serious discomfort to three men, and to make them unfit for work for several days. Not long after this occurrence still another gas cylinder was found in the scrap, and examination revealed the fact that it contained something like 25 pounds of anhydrous ammonia. This also might have caused trouble if it had been put into the furnace or left lying about the plant. As a result of these experiences, an order was issued to the effect that all cylinders thereafter received should be taken to the "skull-cracker" and broken up, before charging them into the furnace. There are at least two lessons to be learned from these experiences: (1) Compressed-gas cylinders should not be exposed to high temperatures unless it is known, positively, that they are *entirely* empty (and if the valve is still in place and closed, and there are no easily seen openings in a tank, it is safer to assume that it is *not* entirely empty); (2) all possible precautions should be used when opening gas cylinders, even if they are supposed to be empty —do it out-of-doors, be sure there are no fires or open flames anywhere in the vicinity, and have the work done by some person who understands the dangerous properties of gases.

A warning of particular importance to the user of compressed gases is this: Be sure each cylinder is empty before discarding it, and if any gas remains in the cylinder see that the cylinder is put in a safe place and marked in some way so that it cannot possibly be thrown on the scrap pile through error. Instead of scrapping a gas cylinder, return it to the gas manufacturer. If it is in good repair it has a money value and can be re-filled and sent out again; and if it is no longer serviceable, the manufacturer will know how to dispose of it safely. If a cylinder is received in a leaky condition, leave it out in the open air and protect it so that inquisitive persons cannot be harmed by the escaping gas; and if the gas remaining in the cylinder cannot be used safely, notify the gas manufacturer and ask for instructions regarding it.

KEEP CUSTOMERS OUT OF SHOP

On page 48 of this issue one of our practical friends, G. F. King, warns welders to keep curious customers out of the welding shop. It's a good suggestion. M. Keith Dunham said the same thing in his "Reminiscences." In his case, an impatient customer talked him out of properly preheating a cylinder block. Demonstrations serve a useful purpose—but every job should not be a demonstration.

THE AMERICAN RAILWAY ASSOCIATION

Section 3 of the American Railway Association has a welding committee and, as the work of the committee progresses, no doubt the committee's recommendations will be followed by most of the American railroads. One useful thing the American Welding Society is going to do is to give co-operation, advice and assistance to this committee, as well as welding committees of other organizations. If the American Welding Society did nothing more than to straighten out the railroad welding tangle, it would be deserving of the support and sympathy of the welding trade.

MANUFACTURING AMERICANS

It is a hopeful sign for the future of our country that the interest manifested by many American industries during the war in the development of American citizens from foreign raw material in the United States is being carried on in some localities now that the war is over. The work should be encouraged in every locality where there is a foreign-speaking or foreign-thinking element.

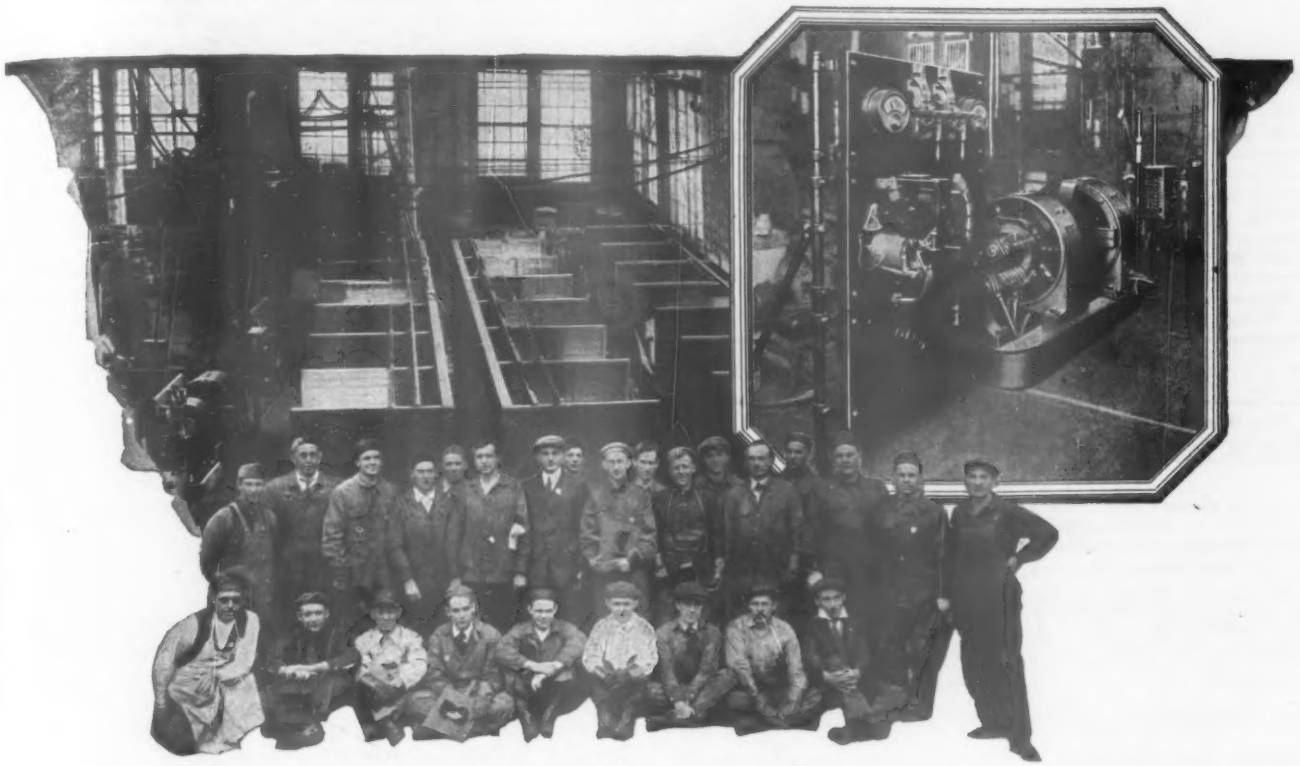
In the current issue of *Gasometer*, a monthly publication devoted to the interests of the Chicago employes of the Oxweld Acetylene Company, the company invites attendance of all who desire to avail themselves of the privileges of the company's night school. The invitation reads in part:

"This company is interested in your welfare and will do everything possible to assist you in getting an education. We have organized for your benefit a class in Americanization work and English. A class in mechanical drawing is also in operation. We have been able to secure the best teachers on the staff of the Board of Education. This is your opportunity. Can we help you?"

The Oxweld Acetylene Company have factories at Chicago and Newark, N. J., and are the largest manufacturers of welding and cutting apparatus in the world.

The Transportation Engineering Corporation, manufacturers of the Wanamaker Coated Electrode, have opened offices at 608 S. Dearborn St., Chicago. Mr. K. R. Hare is district manager.

Specialized industrial training eliminates mistakes that are costly in time and material



Free School for Arc Welders

THE above illustration shows three views taken in the General Electric Company's Arc Welding School at Schenectady, where courses are given in horizontal, vertical and overhead welding, including:

Repairs to steel and iron castings
Welding steel plates, tanks, gear-cases, etc.
Recovery of broken taps and drills from castings
Welding of high-speed steel to low-carbon steel
Welding and cutting by carbon arc
Welding by metallic arc
Assembly of various parts by arc welding

In from six to eight weeks, men who have had no arc welding experience become efficient welders at the General Electric Company School in Schenectady.

Each student's record is kept and will be mailed on request to employer sending him to the school.

This training enables an operator to hold a steady arc of uniform length, which is necessary to produce a successful weld.

Many prominent firms, and departments of the U. S. Government, have availed themselves of the opportunity to have their men receive this exceptional training.

Instruction is free of charge to a limited number of men desirous of learning electric arc welding.

More details in Bulletin No. 48953 of our Arc Welding School sent on request.

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General Office Schenectady, N.Y.

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Fighting Fire with Fire

THE literature of the pioneer days in the prairie states is replete with stories of emigrants who finding themselves in the path of a prairie fire, restored to the expedient of lighting another fire which cleared a refuge for them before the oncoming rush of flames could harm them.

Modern fire-fighters today combat flame with flame, but in another way. No up-to-date fire department is now without its oxy-acetylene apparatus for cutting away metal obstructions that may be interposed between the firemen and expeditious performance of their work. It may be a grating or an iron door that must be wrecked at a moment's notice to admit the passage of the hose and men, or to afford an entrance for rescuers. Sometimes it is the metal hull or hatch of a ship that must be penetrated in order to fight a fire in the hold. Whatever the obstacle it must be removed with the least possible delay.

Axe, crowbar and sledge are of little avail against steel and iron. Work that would require hours with these implements must be done in minutes. And it is done. The fire departments now use the oxy-acetylene torch, the only device that has been found adequate to the emergency. By use of the cutting blowpipe no metal barrier can stand long in the way of the modern fire-fighter. His outfit is easily portable, so that he can work with it at the critical point the moment it is needed. There is no delay. It is already set up ready to use when it is brought to the work.

It would be an endless undertaking to enumerate the instances in which this apparatus has aided in combating fire and in effecting the rescue of lives that must have been sacrificed without quick availability of the cutting torch. Such examples are so frequent that the day is not far distant when complete oxy-acetylene cutting equipment for fire departments will be required by law.

Who Pays the Freight?

IF it had not been for American technical papers, our war preparations would have dragged—there wouldn't have been any Chateau Thierry. It was the army behind the army that made possible the gallant record our boys made on the fields of France. And the army behind the army is here because of the liberal policy we have always believed in with respect to educational matters, schools, good literature, etc. Technical papers are the livest and freshest of all of our educational literature. They furnish to the worker the greatest possible amount of valuable help and information at the lowest possible cost.

But the United States Government is today making it harder and harder for the publishers of technical magazines to reach their subscribers. As everybody knows, first class mail deliveries are bad enough, but second class deliveries are not only bad but unreasonably expensive as well.

Publishers do not ask of the Government something for nothing. They are willing to pay for the service received, but unwilling to pay a high price for a low grade service.

On July 1st there will be a further very substantial increase in second class rates, which means that it costs more to deliver your copy of *The Welding Engineer*. We much prefer to put our money into giving you a better paper and we suggest that you write your congressman and tell him what you think about the matter. He won't listen to a few hundred technical editors, but he does respect a few million intelligent voters.

Licensed Welders

WOULDN'T it be a fine idea to require every welder to take out a license to weld? Then, suppose we require him to carry a small steel stamp, bearing a serial number, and stamp every weld he makes. When he places his stamp, or his guarantee, on his finished work, he would do so with the full knowledge that if his weld proved to be a bad one he might find himself without a welding character. The plan sounds too good to be true, but something along these lines is bound to come.

Welding Progress

THE progress the rank and file of welders throughout the country are making is a source of gratification. Welders are learning and they are securing better and better results. This is due, no doubt, to the very keen interest they take in their work and the pride they have in making something useful out of something that has passed into the discard. Doctor Welder looses a poor unfortunate patient occassionally, sometimes through his own fault, but more often because the case was hopeless to begin with, but nevertheless his profession is commanding more and more consideration and respect.

HERE IS SOMETHING OUT OF THE COMMON, WATSON

[From the Coffeyville, Kan., Sun.]

One hundred dollars reward for the recovery of the body of Hale Short drowned in the river on the night of the 17th. The body, can be recognized by the form that Short had an impediment in his speech. For any information you may need call on Thornton Bros. and let us show you our method of relaying wornout shears at a reasonable cost.

Thornton Bros.

We also weld broken castings, no different how difficult the job may be, we make it like new.

Will some welder please step forward and offer to weld the Republican party, so there won't be any accidents.

THE GENIE OF THE BOTTLE

LIKE the Genie from the "Arabian Nights", Prest-O-Lite is a wonderful force confined in a small cylinder.

It is subject to the command of its master—the trained welder and cutter. Under his direction it performs feats of wonder—anywhere, at any time.

In the subway builder's excavation, in the floating dry dock, in fact *any place—any time* where welding and cutting metals are required, the ready portability of Prest-O-Lite is an asset of genuine worth.

Ask us about the service plan of the Universal Gas with the Universal Service.

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SPEED OF METAL ARC WELDING*

By Wm. Spraragen†

Three years of concentrated effort has done a great deal in clearing away the mystery attending the successful employment of electric-arc welding. Its range of applicability is almost universal in extent, and it is even now considered as the greatest mechanical process of today. There was a time when the wearing away of a fraction of a cubic inch of metal from one of the wearing surfaces of a steel part made it necessary to scrap that particular part. With the introduction of autogenous welding processes it became possible to stop this economic waste. Its further extension to the repair of broken and incorrectly machined parts and defective castings have already resulted in the saving of millions of dollars.

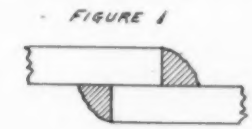


FIGURE 1

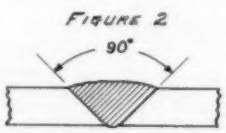


FIGURE 2

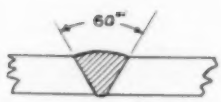


FIGURE 3

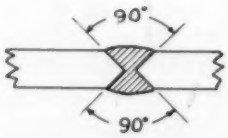


FIGURE 4

Enormous effort has recently been made to reduce the process of electric-arc welding from an Art, dependent entirely upon the skill of the operator, to a scientific engineering basis. While it is still recognized that the operator is the most important factor in the making of a successful weld, a great deal has been accomplished in determining the practical limits in which one must work in order to be reasonably sure that his efforts will be attended with success.

Speed of Arc Welding

One of the most fundamental problems in the application of welding is to be able to compute the time of welding and to know upon what factors this time depends. The usual custom has been to express the speed of arc welding in feet per hour for different thicknesses of material. On first thought this would seem to be the simplest way of giving the desired information in the form in which it would be used. When one attempts, however, to use these figures as a basis for compution as to the cost of doing a given piece of work, he finds this information is too vague to be of value.

Type of Joint

Obviously the number of feet that could be arc welded in an hour for a definite thickness of plate would depend very largely upon the type of joint that was involved. This can readily be seen from Figures 1, 2, 3 and 4.

For instance, an average speed of arc welding a lap joint on half inch plate shown in Figure 1 might be 1.7 ft. per hour, while under identical conditions the butt joints illustrated in Figures 2, 3 and 4 could be welded at the rate of 1.5 ft., 2.3 ft. and 2.5 ft. per hour respectively. This situation

FIGURE 5

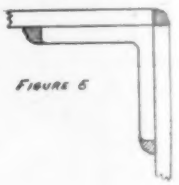


FIGURE 6

FIGURE 7

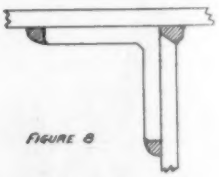


FIGURE 8

is still more complicated when one attempts to form an estimate on special joints sometimes met in practice, such as illustrated in Figures 5, 6, 7 and 8.

These difficulties could partly be avoided by expressing the data on the speed of arc welding in pounds of metal deposited per hour. It would then only be necessary to divide the pounds of metal that could be deposited per hour by the weight of added metal that would be occupied, say per foot of weld, in order to determine quite accurately the rate in feet per hour of welding the particular joint in question. In estimating this volume it would be advisable to add 10 to 20 per cent to allow for the fact that the added material rises somewhat above the surface and is consequently of a somewhat larger cross section.

Pounds of Metal Deposited Per Hour

The average results of a vast amount of data show that an operator can deposit about 1.8 pounds of metal per hour.

*Paper read before the first annual meeting of The American Welding Society, Apr. 22, 1920.

†Engineering Dept., University of Washington.

This r depends largely upon whether the work is done out in open or in a special place provided in the shop. For ou e work such as on boats, an operator will not

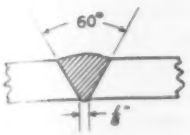


FIGURE 9

SPEED OF WELDING 2.3 FEET PER HOUR 1.1 POUNDS OF ELECTRODE WIRE NEEDED PER FOOT OF WELD

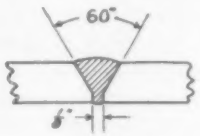


FIGURE 10

SPEED OF WELDING 2.6 FEET PER HOUR 0.9 POUNDS OF ELECTRODE WIRE NEEDED PER FOOT

average in general more than 1.2 pounds per hour, while in the shop the same operator could easily deposit the 1.8 pounds stated above. This loss in speed for outside work is brought about largely by the cooling action of the air and also somewhat by the added inconvenience to the operator. The value of pounds per hour given above is based on the assumption that the work has been lined up and is ready for welding.

Amount of Electrode Material Needed.

In this connection it might also be important to know the amount of electrode material that would be necessary to complete a given job. In welding up some 10 tons of ship plate for test purposes the author has found that on the average 70 per cent of the weight of electrodes is deposited

FIGURE 11

BADLY DESIGNED JOINT FOR "HORIZONTAL" WELDING

in the weld, 12 per cent is burned or vaporized and the remainder 18 per cent is wasted as short ends.

Cost of Labor and Power

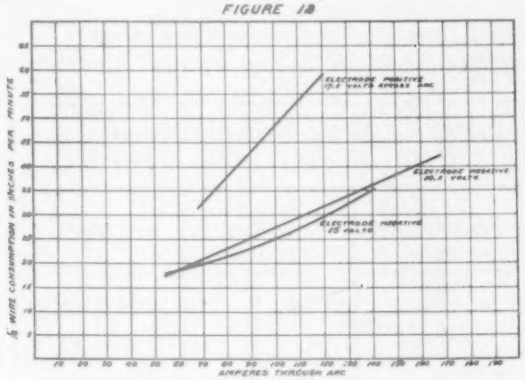
No attempt has been made to include figures of the cost of power and labor. The amount of power that will be required depends largely on the type of apparatus used. Knowing the time it will take to finish a particular job it is a simple matter to compute the power that will be consumed by the particular welding apparatus in use. The cost of labor is a variable quantity depending on the local conditions so that figures which would apply to one place probably would be useless for some other locality. However, it is quite obvious that this could also be readily determined from the time of welding.

Preparation of Welding Edges

It has already been illustrated that the preparation of welding edges has an important bearing on the speed of arc welding. It might be well to note just how far economy may be advantageously practiced in this direction.

In the preparation of welding edges for Butt welds the English practice a year ago permitted the use of smaller angles when the edges were Veed than accorded with the American traditions. At the request of Mr. H. M. Hobart,

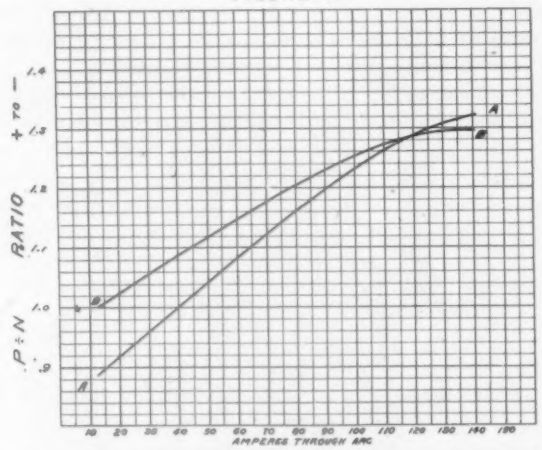
FIGURE 12


ELECTRODE POSITIVE 17.5 VOLTS ACROSS ARC
ELECTRODE POSITIVE 20.5 VOLTS
ELECTRODE NEGATIVE 17 VOLTS
AMPERES THROUGH ARC

CURVES SHOWING THE RATE OF CONSUMPTION OF ⅛" IRON WIRE ELECTRODES

chairman of the Welding Research Committee, the author carried out a series of tests to note the effect of using various angles of opening. The results of the physical tests, together with the time, amount of metal and power consumption for these different angles of opening are given below. In each case a weld 3 ft. long was made in a flat position with a 5/32 inch bare electrode and a "free distance" of ⅛ inch. The specimen was then cut into test strips and subjected to the standard tensile and cold bend test recommended by the Research Committee.

FIGURE 13



CURVES SHOWING THE RATIO OF THE POSITIVE TO THE NEGATIVE ELECTRODE CONSUMPTION

Time, Metal and Current Used with Welds of Different Bevels

	Total Opening of Bevel in Degrees			
	30	60	90	120
Ultimate strength in lbs. per sq. in.	44,000	51,000	45,300	48,800
Angle of bend in degrees which cracks first start	9	15	13	14
Amperes	160	145	118	125
Weight of electrode used up (lb.)	2.56	3.83	4.63	6.63
Weight of metal deposited (lb.)	1.70	2.55	3.65	5.08
Weight of metal deposited (lb.)	0.86	1.28	0.98	1.55
Pounds deposited per hour	1.82	1.61	1.82	1.81
Feet welded per hour	3.22	1.90	1.50	1.07
Circuit kilowatts	9.91	9.00	7.68	8.25
Kilowatt-hours per foot of weld	3.10	4.70	5.10	7.70

These results indicate that the advantages claimed by the American traditions for the very large opening are rather questionable, if we also take into account the time, electrode, material and power saved by the smaller angle of bevel.

Obviously one could have too small an opening in that the operator would not have sufficient room to operate his electrode. This point seems to have been reached for a total opening less than 60 degrees.

There is further basis for belief that a shoulder in place of the heretofore commonly used sharp bottom edge bevel will

CURRENT TO BE EMPLOYED IN WELDING WITH METALLIC ELECTRODES

ELECTRODE DIAMETER, INCHES	PLATE THICKNESS, INCHES	AMPERES
1/16	UP TO 1/8	25 - 50
3/32	UP TO 1/4	50 - 90
1/8	3/16 - 1/2	75 - 160
5/32	3/16 UP	125 - 200
3/16	1/2 UP	175 - 250

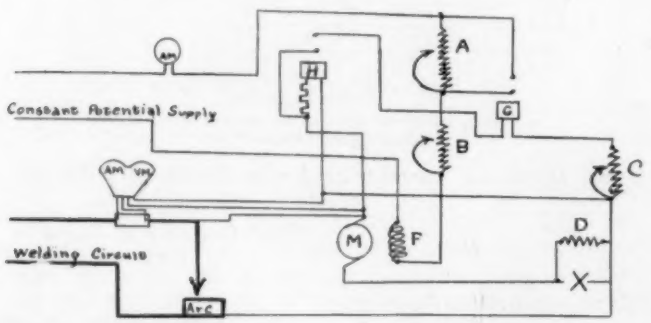
constitute a material gain not only in the saving of welding material, but also in the quality of the welding. The sharp bottom edge is always melted away during the welding process leaving a larger opening than is necessary, or even desirable. The gain in time and material that would result with a 1/16 inch shoulder for ½ inch plate may be seen from a comparison of Figures 9 and 10.

A great deal of care is necessary in the selection of the type of joint. For instance, in order to save time and to provide a shelf to hold the molten metal a type of joint illustrated in Fig. 11 is sometimes used for horizontal welding.

Careful consideration will show that the thermal conductivity of the upper edge is entirely different from the edge of the lower part, so that even the most expert welder would fail in making a sound weld with this type of joint.

Some excellent arc welding is being done with no preparation of the edges at all. The parts are lined up with a slight

Simplified Diagram of Control of Feed Motor For Automatic Arc Welding Machine



opening between them and two operators are employed, one at each side of the weld. A little practice is first required to obtain the proper synchronism between the two operators, but once started the work progresses smoothly. Due to the intense heat of the two arcs, there is no difficulty in obtaining perfect fusion even with plates of one inch thickness.

In all arc welding work the surface to be welded should be clean, and free from scales, rust, grease, soot and foreign matter. Impurities always weaken the weld and cause defects of various natures.

When sections of ⅛ inch or less in thickness are to be joined, edges need not be beveled, but they should be separated a small amount. Thicker sections should have the edges beveled to form a total opening of 60 degrees as well as separated ⅛ inch.

Effect of Position

Welding in an "overhead" position or, in fact, any place where the welder is cramped in his movements will naturally decrease the speed of welding. The speed of overhead welding will rarely exceed 60 per cent of the rate that may be obtaind in flat or vertical position. An average figure for horizontal welding would be 80 to 90 per cent of the rate given for flat or vertical position.

Effect of Current

The amount of metal that can be deposited per hour in welding material of any thickness would vary somewhat with the size of electrodes and current used. The recommended practice of current and size of electrode in welding mild steel plate of different thicknesses is given in the following table:

Current To Be Employed in Welding with Metallic Electrodes

Electrode Diam. Inches	Plate Thickness, Inches	Amperes
1/16	Up to ⅛	25-50
3/32	Up to ¼	50-90
⅛	⅜-½	75-160
5/32	3/16 up	125-200
3/16	½ up	175-250

In general the larger size of electrodes and currents noted above would give a greater rate of deposit, but would require

TIME, METAL AND CURRENT USED WITH WELDS OF DIFFERENT BEVELS

	TOTAL OPENING OF BEVEL IN DEGREES			
	30	60	90	120
ULTIMATE STRENGTH IN POUNDS PER SQUARE INCH	44,000	51,000	45,300	48,000
ANGLE OF BEND IN DEGREES AT WHICH CRACKS FIRST START	9	15	13	16
AMPERES	150	145	118	125
WEIGHT OF ELECTRODE USED UP, POUNDS	2.25	3.65	4.55	6.65
WEIGHT OF METAL DEPOSITED, POUNDS	1.19	2.55	3.55	5.00
WEIGHT OF METAL WASTED, POUNDS	0.86	1.08	0.98	1.65
POUNDS DEPOSITED PER HOUR	1.83	1.81	1.82	1.81
FEET WELDED PER HOUR	3.33	1.98	1.70	1.07
CIRCUIT, KILOWATTS	8.91	8.00	7.68	8.25
KILOWATT HOURS PER FOOT OF WELD	3.10	4.70	5.10	7.70

greater skill of the operator. For the larger electrodes where heavier currents are used the speed of welding may be increased about 20 per cent. However, there are decided limitations to the increase in speed which may be obtained in this manner. Excessive current causes a "cutting" arc which either burns holes in the work or else melts the electrode material so rapidly that it piles up and consequently does not insure perfect fusion with the parent metal. To avoid these undesirable factors the operator is compelled to work intermittently to allow the work to cool somewhat. This waste of time more than offsets the gain in the rate with which the electrode is deposited. One, however, should not infer from these statements that low values of current are desirable. On the contrary the use of higher currents than heretofore has been the common practice will often result in an increased strength of welding. Safe values that may be employed have already been listed in the above table.

Effect of Polarity, Current and Length of Arc

In welding with bare wire the polarity of the electrode should always be made negative except perhaps for very thin work. About 60 per cent of the heat is liberated at the positive side and consequently, since the work due to its relatively large mass, conducts the heat away from the point at which the welding is being done more rapidly than the electrode, it is desirable to have the greatest amount of heat on the parts having the greatest mass. If the polarity were reversed in welding with the ordinary bare wire the electrodes

would melt too rapidly. Perfect fusion with all parts would not be obtained. On the other hand with a slag-covered wire the electrode should be made positive.

It is now generally conceded that in order to obtain a satisfactory weld the operator must hold a short length of arc and consequently the voltage across the arc will be a minimum. Some operators have the erroneous idea that the greater speed of metal deposit may be obtained with the longer arc. With the same length of arc the voltage drop across the arc will be greater if the electrode is made the positive side and the work the negative. A clear notion of the effects of the variation of these factors may be obtained from the curves in Fig. 12.

The data were obtained by feeding an electrode through an automatic device which allowed the arc to play on a metal plate in a manner exactly similar to that employed in practice, with the exception that the electrode was automatically fed instead of hand controlled.

FIG 12—

That the electrode consumption is a function of the current alone and is practically independent of the voltage may be seen from the two curves marked electrode-negative 10½ volts and electrode-negative 15 volts respectively. The increase in consumption of the electrode by making it positive may be seen by comparing these two curves to the one marked electrode positive 17½ volts. The engineer in charge of the development of this machine made the assertion that this was not an experimental accident as the 17½ volt arc with the positive electrode by this automatic feed device is a relatively short arc, while the 10½ volt arc with the negative electrode is a relativly long arc.

To further illustrate the high ratio of positive to negative electrode consumption an arc was maintained between two electrodes of the same kind and the relative consumption of each noted. This latter experiment was carried out for two electrodes of different chemical composition. Curve A, Fig. 13 represents the data obtained with two electrodes composed of nearly pure iron, while curve B is the data obtained by using electrodes of relatively high manganese content.

A. C. Welding Versus D. G.

The author has found where an experienced operator is employed there is very little to choose between the merits of A. C. and D. C. welding in so far as the speed is concerned.

Conclusion

The author trusts that the data contained in this paper will serve as a guide for the estimation of the cost and the speed of welding and the limits within which these factors may be advantageously controlled. Special acknowledgment of indebtedness is due to the assistance obtained from material collected by Mr. H. M. Hobart and R. E. Wagner, of the General Electric Co.

Note: Several articles, belonging in the Society Section, are being held because of the increasing difficulty of securing halftones zinc etchings, etc.; they will be published in the next issue.—Editor.

THE WELDING OF CAST IRON TO STEEL

Editor:

A great many welders still adhere to the idea that it is not possible to satisfactorily weld cast iron to steel. Several have approached me recently in regard to this matter. I have found by experience that it can be easily and successfully accomplished by a simple operation.

It must be taken into consideration that these two metals have melting temperatures which vary considerably, steel melting at approximately 2,600 degrees Fahrenheit and cast iron at approximately 2,100 degrees Fahrenheit. Care must be taken not to heat the cast iron to too high a temperature. Contrary to the generally accepted rules of welding, the steel should not be brought to a molten condition but to an extreme white heat; in other words, to that point where the metal is just about to melt. I should expect some welders to take issue with me in this statement. Some men claim that the steel should be brought to a molten condition, but if this is done the result is the same as when one tries to weld malleable iron—the weld is left extremely brittle and practically worthless.

After the steel has been brought to a white heat and the cast iron to a molten condition, then (using cast iron filling rod because it melts at a lower temperature than steel) dip the hot rod into cast iron flux and apply it to the weld building it up to a point slightly above the level of the metal which is being welded. This will allow for a sufficient reinforcement. Tests have proven that this sort of weld is stronger than the cast iron itself.

E. J. Thompson,
Instructor in Welding, Y. M. C. A. Automotive Schools,
Denver, Colorado.

THE IMPERIAL GENERATOR

The welding trade will be interested in new improvements in acetylene gas generation, as applied to the latest models of the Imperial automatic acetylene generator.

Most important of the new features is the absence of weights, clock-work and complicated mechanism. In the Imperial generator, the carbide feed is simple, sure and dependable, and is automatically controlled by the gas consumed by the torch—the generating of the gas automatically stops when the torch is extinguished and automatically starts generating when the torch is relighted, thus automatically maintaining a constant, even gas pressure.

The machine is of the medium pressure, carbide to water type.

Has Few Parts

Carbide is fed into the water by an entirely new device, very simple in construction and easily controlled. The complete feeding mechanism and carbide hopper are fastened to the head of the machine, making it possible to remove all of the working parts by removing the head of the generator.

The feeding is done by a simple vibrator of the dashpot principle with but one moving part. This vibrator is operated directly by the gas flowing through it from the generator into the torch. The pressure in the generator is con-

trolled by the tension of a spring in a diaphragm governor.

Interlocking safety levers make the Imperial Generator absolutely fool-proof, and compel the users to follow the proper sequence of the operations necessary to start or shut off the generator.

A dependable safety blow-off makes it impossible to obtain more than 15 lbs. pressure, which is recognized as the maximum pressure allowable for acetylene gas.

No Chance for Back Flashes

The gas purifier section of the generator through which all the acetylene gas passes on its way from the generator to the torch has a water seal which cools the gas and absolutely prevents a back flash reaching the generator.

Four sizes, producing 15, 25, 50 or 100 cubic feet of gas an hour, are now on the market. The 15 foot model is particularly adapted to battery service stations for lead burning, light welding and brazing, and for welding where portability is an important factor.

Gas at One Cent a Foot

"Welders will be encouraged to add the Imperial generator to their outfits on account of its money saving virtues," said C. E. Young, sales manager of the Imperial Brass Manufacturing Company of Chicago.

"Aside from the important advantage of never running short of acetylene gas just when you have a rush job to do—as often happens when acetylene cylinders are used, the Imperial Acetylene Generator produces an absolutely pure acetylene gas that insures successful welding at a total cost of about one per cent per cubic foot, a saving of from three to six cents per cubic foot over the cost of gas compressed in cylinders."

THE WELDERS BROTHERHOOD

Editor:

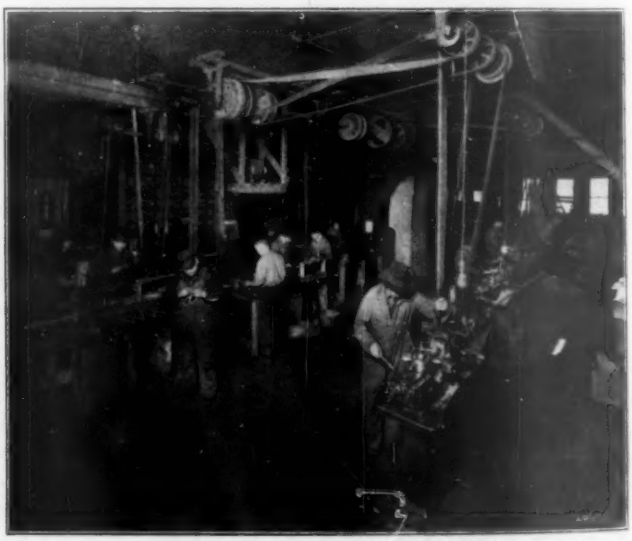
I have at hand a letter from Mr. C. B. Crawford, grand secretary of the Brotherhood of Gas and Electric Welders and Operators of America, and think this is an opportune time to bring the matter of this organization before you, and the readers of your paper, for discussion.

As we of the West get practically all of our trade news from the magazines and trade papers, your columns are the only medium open to us for the discussion of such questions.

New Plant of U. S. Welding Co.

I quote from my reply to Mr. Crawford's letter:

"Assuming that you will give membership cards to all members, the question arises whether it will be a proposition of charging a man in proportion to the classification he CLAIMS, or will there be some other standard than that of money devised for determining the ability of the individual? It would seem that promiscuous scattering of your cards would be a detriment rather than a benefit, unless the matter of classification was given careful consideration, because every employer would look upon them with doubt until he had been assured they were worth more than the paper on which they were printed.



Machine Shop, U. S. Welding Co.

"From the viewpoint of a strictly labor organization, it is evident that affiliation with the American Federation of Labor will be of benefit, but even it will only show that the bearer of the card has contributed his moral and financial support to a movement for his own financial protection, and that card will in no other way better his condition when in search of employment.

"It would be a mighty nice thing if, when the card was presented, the prospective employer could say to himself, 'There can be no mistake in giving this man the position he requests, because I am assured by his mentors he has the ability which

he claim[illegible] His work will be good, and I need not fear to guarant[illegible] it to my own customers.'

"That [illegible] a wonderful Utopian dream, but nevertheless it is the point toward which this trade must aim, strive as a body to promote, and eventually reach. It will be the small force of conscientious welders against the large army of want-to-be-thought-welders, and to a great extent the latter will be the ones to howl if 'Quality' is made the watchword."

This is getting to be an old question. It has been hashed and re-hashed until it looks like we will never get any place, still it seems some method could be evolved. We all have ideas in an abstract form, and if some of your readers will put away fear of public criticism long enough to put their thoughts into words, and mail them to you, we will surely in time reach some definite arrangement.

This is all an absolute necessity, because until such matters are adjusted we can look forward to legislation, and other restrictions that will continue to curtail our field until all we will get will be stove doors and washing machine pants in the commercial job shop.

You have men among your readers who are thinkers and planners. They have asked for suggestions. Why can they not outline some plan, and then ask for criticism?

P. W. Westfall.

RAILROAD WELDING

Editor:

I read with some keen interest the topic, "Welding a worn driving wheel flange" on page 26, March, 1920, but regret to say the writer whoever he may be never spent much time in a locomotive repair shop or he would not have written such an impossible story. He has used for his first photo the title *"Side rods not removed."* He states in his sixth paragraph *the side rods were removed.* Is this self contradictory or not? How does the writer expect any experienced Welding Engineer to swallow this kind of rough dope?

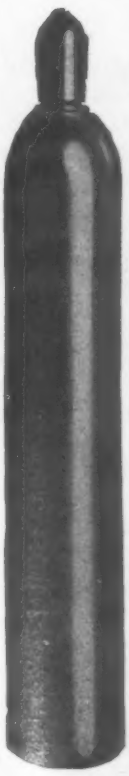
All locomotive repair men know that it requires very little heating either with a gasoline or crude oil flame to remove a locomotive tire. Surely if it were welded for as much as one foot, the expansion of the oxy-acetylene flame would loosen it to an extent that would necessitate the removal

Service Truck, Indiana Oxygen Co.

of the tire and "shims" put under to tighten the tire when put on again. I certainly wish these Welding Engineers would use a slight bit of common sense when addressing the public and not display the idea that the oxy-acetylene process is laughing stock for the mechanical world. This hinders rather than progresses. Silence is more valuable than ignorance in some cases.

John J. Foley.

Manufacturers of
SEAMLESS STEEL CYLINDERS



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Interstate Commerce Commission Specifications

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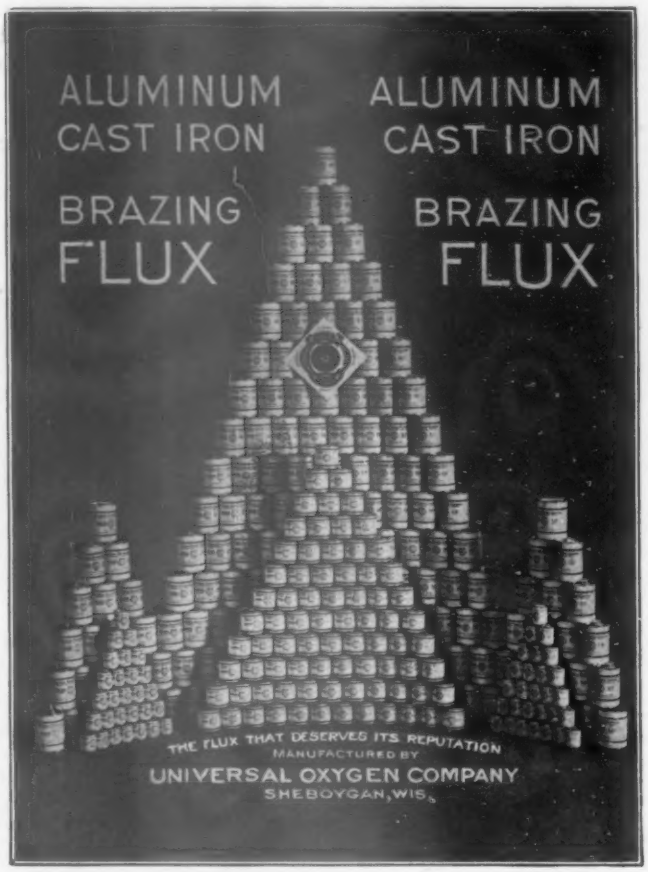
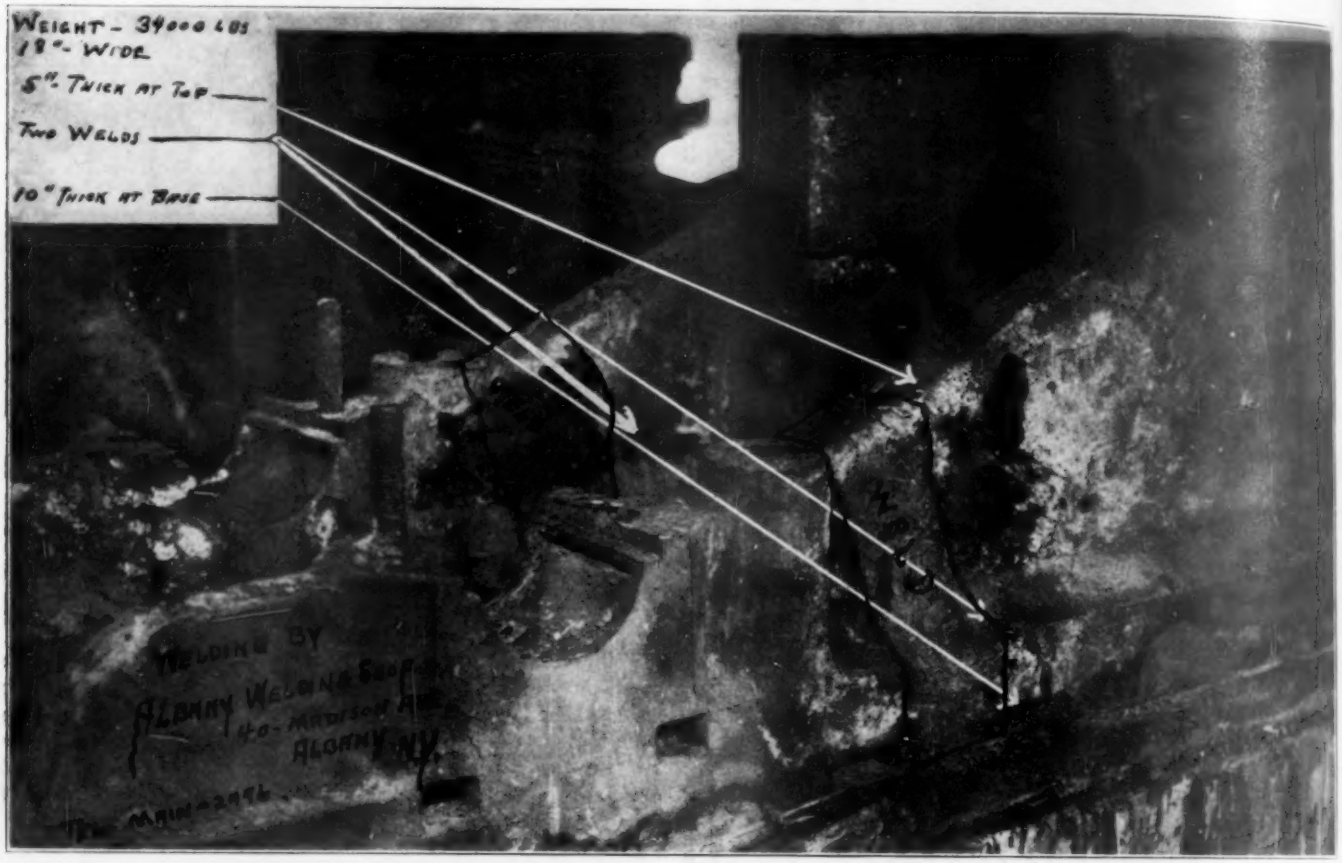


RESURRECTING A SEVENTEEN TON PATIENT

The above views represent a remarkable feat in oxy-acetylene welding, one of the largest castings welded in New York state.



Giant shears, 34 feet long and 12 feet in width, the weight of this shear bed is 17 tons. It will be noted by outlines in photographs that this mammoth shear bed was broken squarely in two, which called for two welds, each weld being 18 inches in length, 5 inches in width at top, and 12 inches in width at base of shear bed.

This remarkable feat on this mammoth casting was executed by Mr. Ray Gaul, proprietor of the Albany Welding

Shop, Albany, N. Y., and required 9½ hours of actual welding, using a Davis-Bournonville Large C style torch, with size 12 tips. The job when completed was perfect, and these giant shears are doing duty each day, and saved a rolling mill an enormous sum, as well as months of time.

Mr. Gaul is one of the pioneer oxy-acetylene welders in New York state, receiving his early training with the Davis-Bournonville Co., and has been in business for himself for about eight years in Albany, N. Y., and makes a specialty of the larger and most difficult welding propositions, a large share of his work being shipped in to him from distant points. Mr. Gaul's line of work and his large shop is an inspiration and shows what can be accomplished by oxy-acetylene welding if one will run the business as it should be and master the art.

ARMOR PLATE SCRAP AT SANDY HOOK

The Oxweld Acetylene Company, of Newark and Chicago, which was recently awarded the government contract for cutting 4,000 tons of armor plate scrap to charging box size at Sandy Hook now has a crew of oxy-acetylene cutters on the job. The plates, 3 inches thick by about 9 feet x 13 feet, weigh between seven and eight tons each, and are being cut into sections 13 inches x 25 inches, each weighing around 300 pounds. The weights vary somewhat owing to the necessity for cutting through the shell holes, each plate having been punctured six times by heavy artillery shells for which they were made the targets in the big gun tests conducted at Sandy Hook during the war.

This is one of the largest jobs of the kind that has ever been undertaken and was awarded to Oxweld in a competitive bid. Several weeks will be necessary to complete the work. Oxweld's ability to underbid competitors for the big job was due to the economical consumption of gases in the injector type of blowpipe manufacturer and used by this company. The oxy-acetylene process is the only one by which salvage work of this character can be satisfactorily handled.

The K-G Welding & Cutting Co., Inc., New York City, have opened an office in Chicago at 12 and 14 East Harrison St. The office will be in charge of William McCarthy.

The Electric Arc Cutting & Welding Co., has inaugurated a campaign to promote better welding shops throughout the country. Details of the plan will be furnished upon request.

WANAMAKER
COATED
ELECTRODES
for
ARC WELDING

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The Technically Correct Electrode

TRANSPORTATION ENGINEERING CORP.

200 Fifth Avenue — NEW YORK
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Write for Bulletin

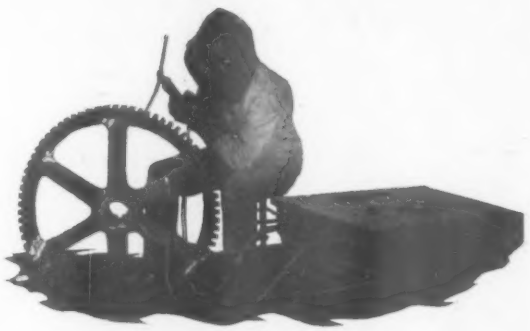
ALUMINUM SOLDER

That is Aluminum Solder Applied with a Soldering Iron

We wish to present an ALUMINUM SOLDER that is entirely new to the welding fraternity.
Any man who knows the first thing about using a soldering iron can complete a far superior aluminum weld with our Aluminum Solder than the most experienced aluminum welder in the country under the old method.
Aluminum welding has always been a very difficult operation, and one that required the highest experience known in the business, but today by the aid of our famous WELDIT Aluminum Solder a novice or tinner can make an aluminum job far superior to anything ever attempted heretofore. There is no long drawn out set of instructions to go with this solder. All that we ask is that you warm up the casting pretty well with the torch, then clean the Aluminum crank case or sheet thoroughly and rub the solder into the broken part with a large size soldering iron, very hot. It is practically impossible to break the joint and will hold far better than the average aluminum weld. It is generally the simple mechanical operations that are the best, and this is unquestionably a specific case.
Do not fail to send for a trial pound of this material. No samples furnished free. We will not ship C. O. D. We guarantee this to be superior to anything ever shown, or your money will be refunded upon receipt of returned solder.

Price $2.50 per pound

WELDIT ACETYLENE CO.
68 W. Grand River Ave.
Detroit, Mich.



Bulletin 104

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HEAT CONTROL
HIGH EFFICIENCY
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PORTABILITY (Weight 265 Lbs.)
USES ANY TYPE OF ELECTRODES

Our Flux Coated "NEWARC" Electrodes make perfect welds. Ask for information—it will pay you.

Electric Arc Cutting & Welding Co., - Newark, N. J.

Campbell's "Oxy-Acetylene" Welding Manual

By Lieutenant Lorn Campbell, Jr.
Ordnance Corps, U. S. A.

Lieut. Campbell organized and conducted the Army Welding School at Peoria, Ill. His new manual is based on his experience there, in training soldier welders. 154 pages, 89 illustrations, bound in cloth, $1.25.

THE WELDING ENGINEER
Chicago, Ill.
608 S. Dearborn St.,

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III. Shop Equipment.
IV. Apparatus repairs.
V. Preheating Agencies.
VI. Part One—Welding of Cast Iron.
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LARGE PROPELLER JOB

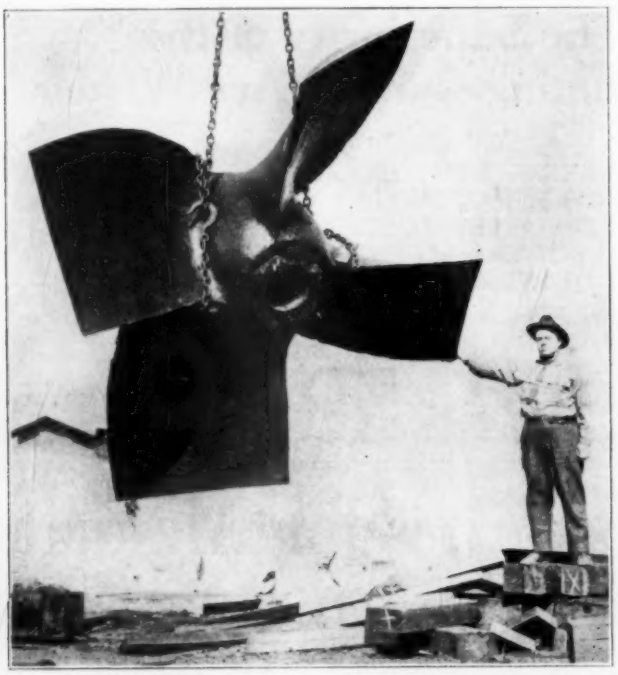
Editor:

We are mailing you, under separate cover, three photographs showing a large propeller welding job. This was done with Purox apparatus at the Southwestern Shipbuilding Company, Los Angeles Harbor, and consisted in welding

The Crew That Done the Work.

four new blade tips on a 9½ ton cast iron propeller on the 12,000 ton standard oil tanker "Tascalusa."

One picture shows the propeller with the blades cut off, preparatory to welding on the new tips. The new tips were about five feet long, 48 inches wide and four and three-fourths inches thick, and the propeller measured from tip to tip twen-

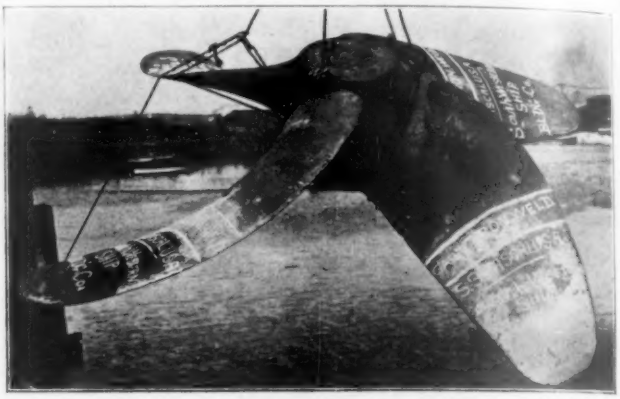


Propeller with Blades Cut Off.

ty-one feet and eight inches. The original cost of which, we were informed, was $11,000.

The propeller and tips were V'd and welded from one side only. The V was about 6½ inches across at the top. After being placed in position over a gas furnace each blade was preheated for about four hours. Actual welding required thirty-four hours, equivalent to eight and one-half hours on each blade, and a total of 1,260 pounds of filler rod was used.

Four welders worked on the job, two at a time in five minute shifts. Purox No. 3 welding torches were used and although the same became red hot half way back to the mixer, no flash-backs were experienced. Upon completion of the job, all blades lined up perfectly, with the exception of one, which was out of line just one-thirtysecond of an inch.



The Finished Article.

The job was inspected and passed by Lloyd's Insurance Company which carries, we were informed, $1,500,000 insurance on this vessel. The photographs speak for themselves, and require no further comment from us.

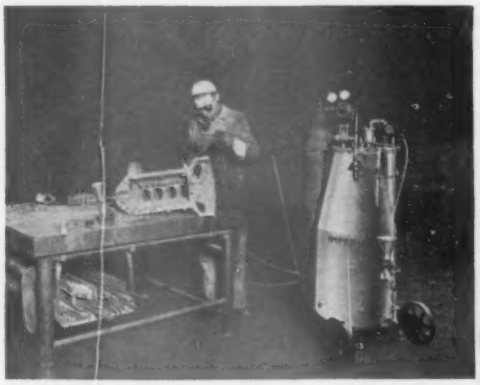
Burdett Oxygen Company.

The Davis-Bournonville Company have just issued a temporary catalogue of D-B acetylene generators, welding and cutting torches, pressure regulators, portable outfits and supplies. A cabinet truck is illustrated which provides perma-

Barney Oldfield Uses Oxygen on "Oldfield Tires."

nent mountings for the pressure regulators inside a steel locker together with a safe storage for torches, tools, etc. A new series of pressure regulators are illustrated which are made of press forged bronze.

Make your own Acetylene Gas!



With an Imperial Automatic generator you can make acetylene at about one-fifth the cost of gas compressed in cylinders.

Eliminate express bills, dray hire, delays while tanks are refilled, running short of gas on a big job—the high cost of welding—all these are done away with the day you

Install an

IMPERIAL AUTOMATIC ACETYLENE GENERATOR

Remarkably simple—no clockwork, weights, or complicated mechanism control its operation. The feeding is done by a simple vibrator of the dashpot principle with but one moving part. This vibrator is operated directly by the gas flowing through it from the generator into the torch. Gas generation can start only when the torches are lighted and stopped when they are extinguished, making the generator absolutely automatic.

No acetylene regulator is required as an absolutely constant pressure is maintained at all times. Imperial generators have been used for hours at a time without it being necessary to adjust flame of torch.

A water seal cools the acetylene and prevents a flash back from ever reaching the machine. Interlocking safety levers compel the user to follow the proper sequence of operations necessary to start or shut off the Imperial Generator.

The Imperial Automatic Acetylene Generator is of the medium pressure, carbide to water type, and is made in 15, 25, 50, and 100 pound sizes.

Write for Facts

Your present welding equipment will return bigger profits the moment you adopt this modern, money-saving system of generating acetylene gas. You know Imperial quality—that's enough! Write today for complete information.

The Imperial Brass Manufacturing Company

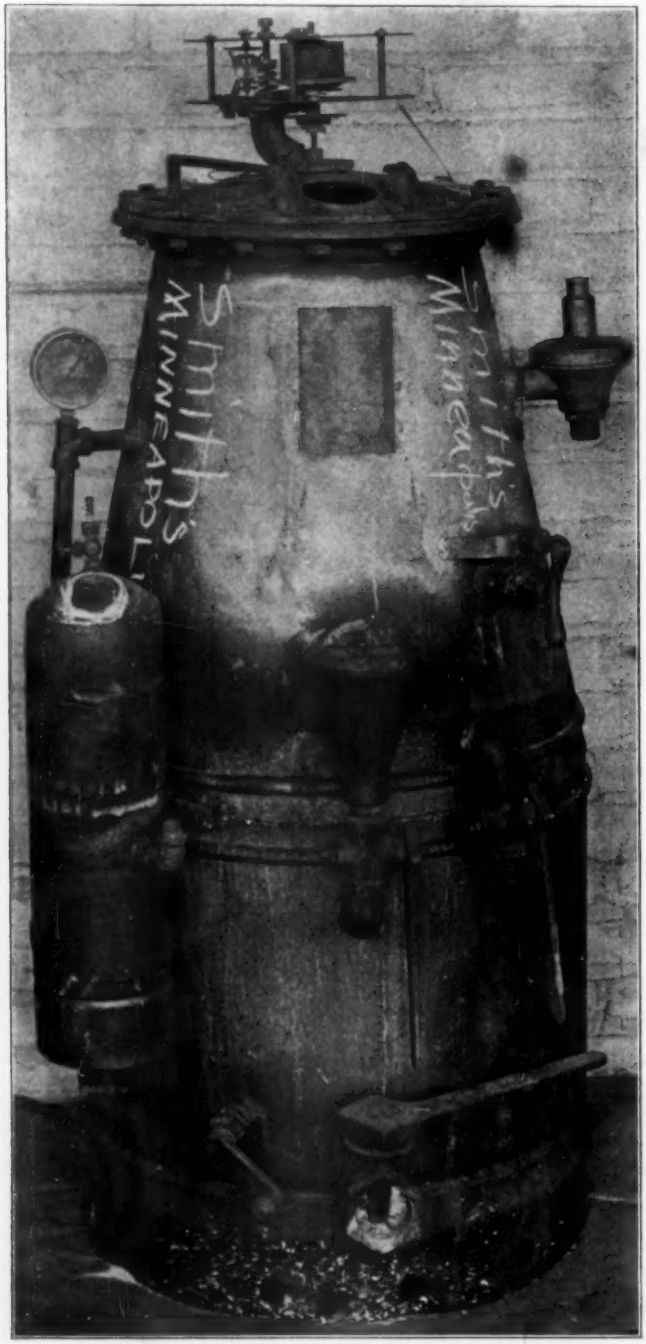
517 South Racine Street, Chicago, Ill.

Makers of welding, cutting, carbon and lead burning equipment and supplies

GENERATOR PASSES THROUGH FIRE

Editor:

We are often asked what would happen in case a generator went through a fire. As an answer to this question the enclosed photograph will be self explanatory. You will notice that the gasket burned out, the wood burned off of the winding handle, the weights melted out of the governor, and



Generator Passes Through Fire.

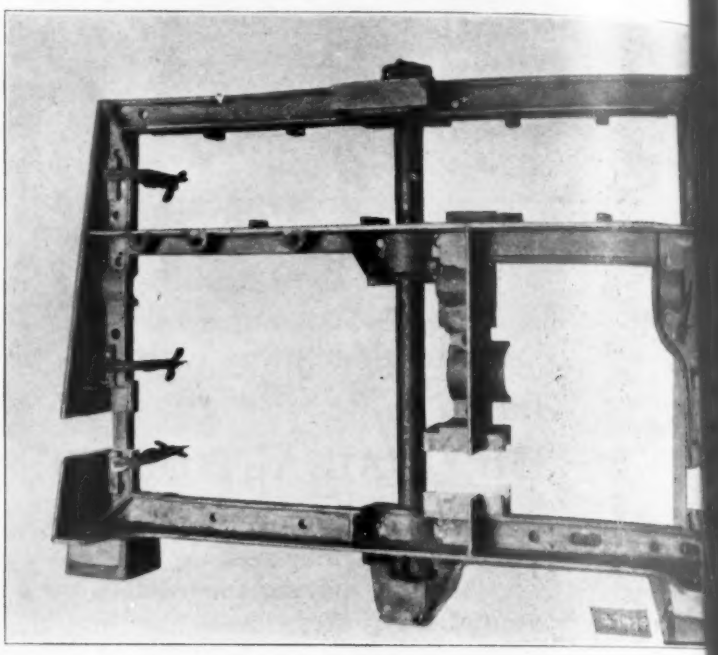
one of the brass gears was partially melted. The generator did not open up in any of its seams and was tight again upon replacing the gasket and repairing the blow off valve.

You will notice that the top of the flash back chamber has a small hole punctured through it. This was caused by steam generating in it by the excessive heat. The top of the flash back chamber was bulged out and stretched until it ruptured, allowing the steam to escape, the check valve preventing the pressure from going back into the generator itself. There was no explosion of any kind and the gas burned quietly as it escaped.

Smith's Inventions Inc.
E. H. Smith.

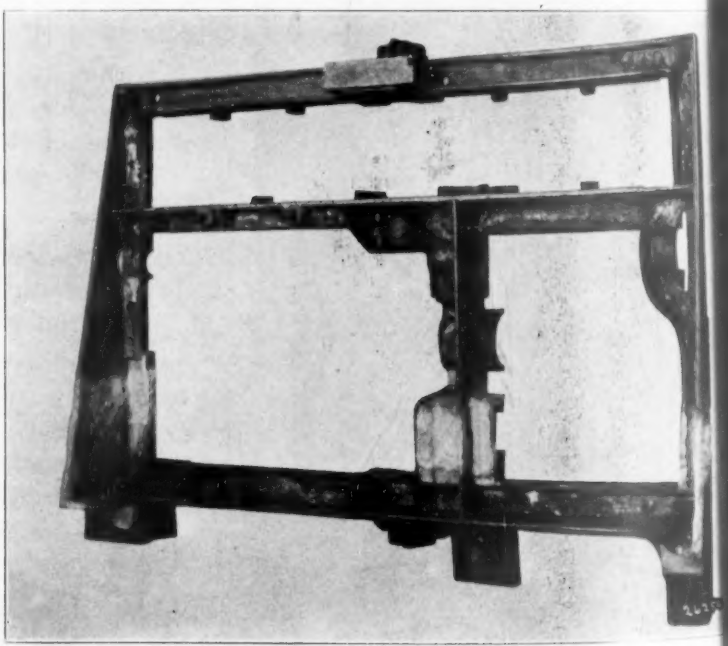
RECTIFYING MANUFACTURING ERRORS

Rectifying errors in manufacturing is proving one of the possibilities for oxy-acetylene welding. A typical example is illustrated in the accompanying photographs of a tractor



frame aluminium pattern. This pattern after casting and finishing was found too narrow and consequently useless for the purpose for which it was designed.

The manufacturers were loathe to scrap the valuable pat-



tern (it was worth $250) and decided to weld in the necessary extra width. The work was done with Airco oxygen, Airco acetylene and a new Airco "A" welding torch.

The total cost of the labor, supplies, etc., was $75. The saving amounted to approximately $175.

Welding Rods

CAST IRON
MALLEABLE IRON
NORWAY IRON
NICKEL STEEL
VANADIUM STEEL
CAST ALUMINUM
MANGANESE BRONZE
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ALL MATERIALS

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ELECTRIC WELDING

By ERIK OBERG

A Practical Book on This Important Subject and One That Embodies the Results Obtained and the Methods Used by the Most Prominent Concerns in the United States.

295 Pages, 6x9 Inches, 213 Illustrations

PRICE, $3.00

Electric welding has become so important an art in the mechanical industries that a comprehensive treatise on this subject covering both the resistance and the arc welding processes is needed in the trade. A special study of the subject has, therefore, been made by the authors of this work, who have been assisted in their work by the experts in resistance and arc welding of some of the most prominent concerns in the United States engaged in this line of work.

Consultations with the experts of these companies have made it possible to obtain thoroughly up-to-date information embodying the latest developments and discoveries in the art, and it is believed that, for this reason, the book will prove especially useful to those who are already employing electric welding equipment or who are contemplating its use, as well as to the students of the subject who desire to obtain authoritative information on the electric welding processes.

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Electric Welding Processes—Electric Resistance Butt-Welding Special Butt-Welding Machines and Processes—Electric Spot-Welding—Seam-Welding and Riveting—Percussion Welding—Electric Soldering—Principles of Electric Arc Welding—Applications of Electric Arc Welding—Welding Transformer Tanks by Electric Arc.

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The first illustration shows the pattern cut into sections and separated to the required width. The second photograph shows the pattern after welding and ready for finishing operations.

PREHEATING IN A JOB WELDING SHOP

By P. W. Westfall

Every welder knows that present day charcoal is poor in quality, high in price, and frequently unsatisfactory for the preheating of delicate cored castings.

Where artificial or natural gas is available it can be used as a substitute for charcoal on all but the heavy castings where uncontrolled heat is not a great disadvantage.

For preheating crank cases, cylinder blocks, and other similar castings a furnace should be constructed, using a sheet of steel, or preferably cast iron, at least two inches larger in dimensions than the casting to be heated. This plate should be placed on three or four half-bricks, on the plate arrange the casting, and wall in solid with fire-brick. No ports or vent holes should be left, but the walls should be so arranged as to allow a space of at least one inch all around base plate for circulation of heat.

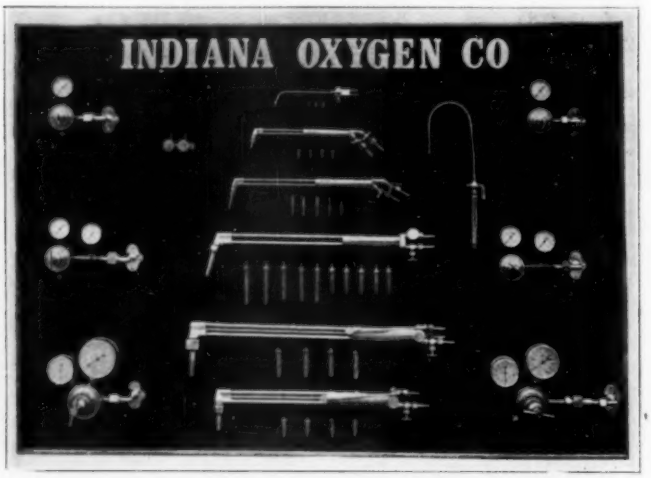

Exhibit of Rego Apparatus.

In one end, at bottom, should be left a tuyere or port only large enough to receive the nozzle of the preheating torch, the flame from which should be directed *underneath* the base plate.

After raising side walls above the top of the casting, the furnace should be covered over with a sheet of asbestos or plate. It is important that this plate should fit closely to the walls, leaving no gaps, so combustion can be controlled by the air adjustment of the preheating torch.

When torch is first lit flame should be kept low for a short time, and then extinguished to allow the casting to absorb heat slowly. Torch should be again lighted, and again turned off after a short time. The intervals and heat should be so gauged that at this time the casting will be hot enough to "sizzle" when touched with the end of a damp finger, when torch can again be lighted and the flame be increased until full pressure is being used.

It will be found that castings can be brought to a welding heat in about half the time necessary with charcoal—without ashes or dirt. The temperature will raise very slowly above a dull red and will seldom go above a cherry red unless the sections are exceptionally thin.

As welding progresses, more heat can be added at any time by covering job over and lighting gas for a short time.

Polished surfaces such as cylinder walls, if covered with powdered graphite and oil before heating, will be found to retain this polish without any scale forming on the surfaces.

Heating castings in this manner will be found to be an excellent substitute for the higher priced preheating devices which are too expensive for the smaller job shops.

Where compressed air is not available a torch can be purchased which has an electric blower built integral with the burner. It can be connected to any electric light socket and operates at about the same cost as a lamp. The torch and full set of burners costs about sixty dollars as against the cost of compressing and piping air.

After welding is finished casting can be heated and allowed to cool slowly in same furnace.

WE NEED MORE OF THESE

Editor:

I do not want to take up too much time and space in your magazine but I would like to write just a few lines to let you folks know how we are getting along here in the welding game at the State College, Brookings, S. Dak. In our Auto Mechanics' Department we have enrolled 112 students. There are several lines of work that they may take up as a specialty, such as ignition, auto repairs, tractor work and oxy-acetylene welding. The welding runs in parallel with the whole course. All of the auto mechanics get welding, ignition men get the same amount. There are 14 men who specialize in welding alone. They get only six hours per week at forging besides their regular welding course.

The welding course begins with lectures and notes in regard to the different metals. Also, expanding the gases, gauges, torches and flames. Each subject is gone into thoroughly. The student must know how to explain the regulating valves and must be able to draw off-handed the valve and explain every part and its workings. When he thoroughly understands these, he is taken to the welding room and the apparatus is gone over again. He is then taught how to light the torch and to adjust the flame to a neutral cone. He is shown the action of the different metals when they are heated in a molten state. We have problems for the students to make up step by step, each one a little more difficult. We have 30 of these problems, 15 of cast and 15 of steel. We have malleable repairing, brazing, brass welding and aluminum welding. The last six problems in cast iron welding are expansion and contraction lessons. After these problems have all been done by the students in a satisfactory manner, then they must do field welding. They must have 70 hours of practical field work before they can get their standings. The course begins in September and runs to June. We are now doing field welding and have all we can do. We charge only for material and gases.

I am enclosing a few photographs to show you what can be accomplished in welding schools. The Buick six block was frozen and was brought here to be overhauled and welded You will notice by the chalk marks, where it is welded. We placed the block in the oven, head down. Used charcoal to heat and heated it very slowly. I think it was three hours from the time it was put in until it was welded. The Dodge block was cracked in three places, one in rear end and one on each side. It was heated the same way and both are fine jobs. The aluminum case is the lower half of the Dodge. A crack ran almost way around next to oil pump. The pump bracket was also broken.

These jobs were all done by the regular welding students. The writer stood around and looked wise but the three jobs were done without any suggestions. They are also all subscribers to *The Welding Engineer*. So here's hoping we have more welding schools to get better welders in the field and why not hang togther and make the world take notice of the electric and gas welding craft? The writer is at the right in photo.

R. H. Anderson

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CRYSTALLIZATION

Editor:—Answering your correspondent's query on page 64 of the May Engineer, A Welders Union, by Ralph Leonard, of Chanute, Kans., beg to offer the following data which has come under my observation during my past fourteen years' experience in the art of oxy-acteylene welding, brazing and cutting.

Crystallization of iron and steel takes place where the parts being subjected to continuous use and unusual vibration become deadened and lifeless at the point of fracture from overwork and action at their weakest point, as do also human beings from over and unusual exertion. However by proper and scientific heat treatment from time to time, crystallization may be delayed for an indefinite period. Boiler plate the same as other high grades of steel becomes dead and lifeless with age, and the carbon necessary for its preservation is gradually consumed in action, but may be renewed to some extent by intelligent heat treatment.

All oxygen and hydrogen steel cylinders are subjected to a special heat treatment in a charcoal furnace at least once in every three years, for the purpose of delaying crystallization, and to meet with the requirements of the interstate commerce commission laws and regulations. Steel is now however entirely destroyed by crystallization, and the contents while appearing brittle at the point of fracture may be somewhat rejuvenated by proper heat and treating methods and last for years under certain conditions as stated above. Crystallized parts may with proper care and the heat treatment, may be reclaimed, while with burned iron and steel the substance burned is nothing more or less than dross or refuse. Oxidation, and the burning of iron and steel are not one and the same thing. An oxidizing flame, which is an excess of oxygen added to same, is a neutral flame, and a neutral flame must be maintained particularly in the welding of high carbon steel and iron, to make a good strong weld. Cast iron, however, is not necessarily ruined by a slight excess of oxygen, or acetylene in the weld, and neither is bronze or aluminum, but an excess of oxygen in the welding of iron and steel is absolutely ruinous to the parts supposed to be welded. All iron and steel that is actually burned is ruined beyond reclaim, as is the slag, or dross from the cutting torch.

Charles H. Knight,
521 W. Jackson Blvd., Chicago.

OXY-ACETYLENE WELDING AND CUTTING*

There is no question but that welding in general and oxy-acetylene welding in particular is steadily gaining in favor in the boiler industry, as is evidenced by the number of shops in which its use is gradually being extended in regular production.

Although it has been condemned by some individuals, the causes of failures of oxy-acetylene welding are generally traceable to the inexperience or poor workmanship of the operator. To become a good welder or to be efficient in any line of work, it is necessary that a man must like that work and try his hardest at all times to produce the best results of which he is capable.

In the case of oxy-acetylene welding, the operator must study the action of the metal when subjected to the intense heat produced by the flame and understand why the welding progresses as it does. He must watch his flame and keep it neutral and be sure that he is actually welding and not simply sticking the metal from the filler rod onto the piece being welded. He must learn how to handle his torch and the filler to the best advantage. He must also be a cold-blooded sort of chap to be able to stand the intense heat in which he must sometimes work if he is welding a piece surrounded by a bed of red hot coals, as happens when preheating is necessary.

In the shops where the writer is located the torch is put to every possible use in the work. In its cutting capacity it is used to burn out all staybolts and old sheets and to cut all rivets. If the operator is careful, he can bevel the sheets to be welded with the cutting torch and save time and labor that would be required to do the same work with a chisel and air hammer.

Ash pans are in a great many cases welded now and seem to give as good service as pans with angle irons and rivets. In building up ash pans the pieces of plate may be riveted to the casting before or after welding. The sides of the pan are held together at the top by a wire clamp. Before the welding is started, thin wedges are driven between the edges of the plates, forcing them apart about ¼ inch.

All tool boxes used by the engine crews are welded. These boxes are built up of No. 12 gage sheet iron and are 18 inches long, 8 inches wide and 8 inches deep. Welding is done from the inside, the outside edges being smoothed after the operation is completed.

The great speed that can be accomplished in doing any of this shop work by means of welding is very much in favor of the process.

Recently it was necessary for the men in the shop to put a patch in the left back mudring corner of an engine. The patch was to cover an area which included two staybolts, eight mudring rivets on the door sheet, three mudring rivets where it lapped onto the side sheet, and three rivets in the running seam. It took just eight hours for a boiler maker, a helper and a welder to remove the old piece and weld the patch into place. All that remained after this was to drill the holes for the mudring rivets, drive the rivets apply the two staybolts, and chip and calk the patch.

Incidentally, the cutting torch was used to burn off the staybolts and the old sheet, as well as to preheat the patch when it was being laid up.

As yet we have not had to install any new side sheets or flue sheets, but probably will in the near future. When this becomes necessary, we intend to try cutting out the top of the back flue sheet just below the braces and weld in a new top piece, as several of the flue sheets are badly worn in the tube area, but perfectly sound below.—Arthur Malet.

*From *The Boiler Maker.*

Mr. Eugene Schoen, general manager of the International Oxygen Company of Newark, N.J., has sailed for Europe to make an inspection of the company's branches in London and Paris and to extend the business of the company in France, England, Belgium, Germany, Switzerland, Sweden and Denmark, where reconstruction following the war has stimulated the demand for oxygen and hydrogen generating apparatus.

The Standard Oil Company at Richmond, Calif., are replacing boilermakers with welders as far as practicable and as fast as welders can be secured.

The Buckeye Welding & Supply Company of Cleveland, Ohio, have issued a circular describing and pricing welding supplies and equipment of all kinds.

Mr. G. M. Calmback, formerly supervisor of welding for the Kansas City Southern Railway at Pittsburg, Kans., has joined the forces of the Geist Manufacturing Company of Atlantic City, N. J.

What we think of the Second Class Postal rates is as follows: ΘΦΛΣιdι τɯdd ΔϕL ΣψΔγc dʁϕΛλ ΣΣδΠe ѕтɯLnƽ dɯẅβω.

What we think of the welder (?) who is unable to learn a thing from the experiences of old-time welders is as follows: ΘΦΛΣιdι τɯdΔΔϕL ΣψΔγcdʁ ϕΛλΣΣδΠeѕ τɯLɯƽdɯ̃ ξβωρ ιγπϕθɯLλχ.

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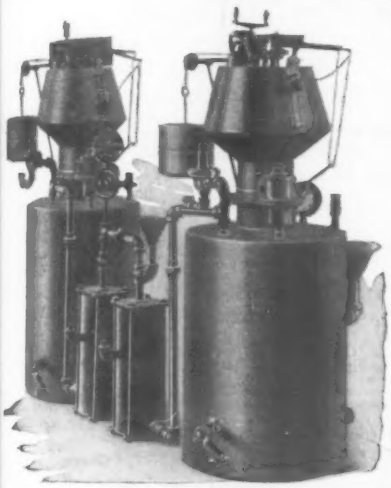

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Hold on! What were you doing just then? Storing away that interesting bit of welding experience, or a photograph, perhaps? Don't do it? Give it to us. We want to show it to 5,000 other readers of The Welding Engineer (you're the fifty-one hundredth). If there are objectionable features to it, just leave it to the Editor (he studied surgery), cutting off and adding to is his hobby.

Another thing, when you work out a successful solution to a welding problem write us about it. Grammar and composition don't count—it's ideas we want. If a sketch would illustrate your job in good shape, just make a rough pencil sketch; our draughtsman will do the rest.

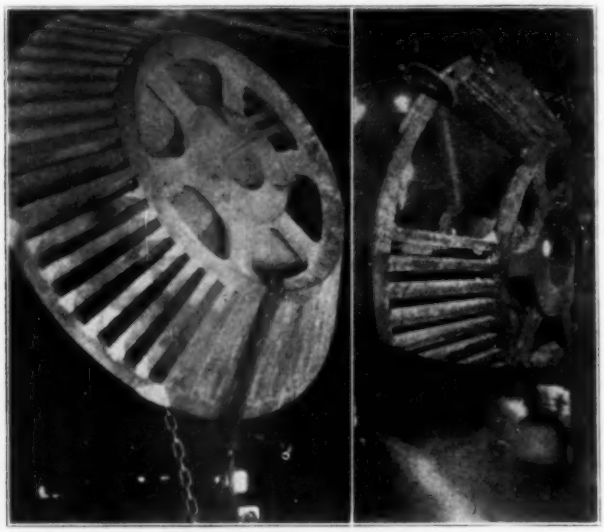
If the welding industry is to grow, you welders must pass along your experiences. We pay for them.

THE WELDING ENGINEER
608 S. DEARBORN ST., CHICAGO

BEVEL GEARS

Editor:

Enclosed please find two pictures of a wooden tooth bevel gear. The teeth are inserted in the spaces between the spokes. The outside rim for 1/6 of the diameter and six spokes were broken out. One of the spokes was broken up so badly that I had to make new ones. The chalk marks on the finished job indicate where the welds were made. I was somewhat puzzled at first how to begin but I finally welded one end of the rim piece in first, then I welded the



spokes in at each end and finally I welded up the last end of the rim piece. If in your estimation this article would be of interest to your readers, I wish you would publish it.

I am a subscriber to your magazine and I find many valuable ideas from the experience of others. Of course, I may not have done this job in the right way but it is running and has not developed any weakness.

E. S. Foster.

"HOW ABOUT A TRIAL ORDER?"

The Dangers of Letting Your Salesmen Get the Sample Habit

By Ray Giles*

One of the branch managers for a mechanical equipment house which does business in all parts of the country sat at his desk. His secretary had just turned over to him the day's batch of salesmen's reports. As he looked them over he remarked, "'Of all sad words of tongue or pen, the saddest are these: It might have been'—a regular sale just as easily as another one of those trial orders.

"If there is any blight that eats holes into sales records," he continued, "it is that last gasp of the salesman who is just about ready to throw up the sponge, when all of a sudden he lets loose the old plea, 'How about a trial order?'

"Listen to these"—and as he fingered a sheaf of yellow slips he paused every now and then to extract a sentence or two from the salesman's remarks.

"One—'Purchasing agent has ample supply of small tools at present time, but has agreed to buy a small quantity of ours and make comparisons.'

"Two—'I could see that Mr. White was greatly impressed by my talk on belting, and he is going to use ours on one battery of machine tools to see how it stands up.'

"Three—'These people certainly gave me a very nice hearing. I feel that they are trying to be entirely fair. They finally agreed to give me an order for our packing, which they will watch very closely for results.'

"Four—'This account is a hard nut to crack, but I made up my mind not to give up and today I kept my foot in the door until I got a try-out order, which I am confident will lead to more business.'

"Five—'I made a long and careful canvass for their mechanical supply business, but, of course, I could hardly expect a big order from them the first time'—

"Why couldn't he expect a big order the first time?" the Branch Manager asked me. "Doesn't he think his line is good enough?" Then more calmly, "Of course, there is a time and a place for trial orders, but sometimes I think we would be a great deal better off if we cut them out of our business entirely. Did you notice the easy way in which the salesman gets to accept the trial orders in those reports? That's the whole trouble.

"Once let a man get taking trial orders, even in a limited way, and pretty soon, without realizing it, he gets reconciled to taking them in larger quantities. Not only that—he gets an attitude of mind that is favorable toward small orders instead of big ones. He gets in sympathy with the customer's tendency to get along with the least possible amount rather than the right amount, and then, as time goes on, the trial order is put over on the salesman often without his being aware of it.

"Not one of those reports uses the words 'trial order.' I wouldn't be surprised if the fellows didn't even realize that they were only acting as members of a sampling crew instead of regular salesmen. Yet when you look into the transactions carefully, as they have set them down in writing, you can see that that is exactly what happened.

"It really wasn't a sale at all. The buyer let them down easy with a trial order, and in such a way that he can say that the goods didn't turn out well when the salesman goes back. Once the buyer has given expression to such an opinion you know how hard it is to resume relations on a first class and business-like basis."

Out of experiences with salesmen and selling methods there stand some striking examples of mistakes made in playing up the "trial order," and perhaps, as the Branch Manager declared, the average trial order is about as respectable as a "trial marriage."

Over and over the attitude of the dealer or buyer has proved wrong toward the trial order. The word "trial" fastens itself in his mind more strongly than any single virtue which the salesman has claimed for the goods. The dealer is not really sold on the merits of the merchandise—it is made plain to him that he is simply "trying them out." Didn't the salesman admit as much? The result is that the user is looking for defects quite as expectantly as he looks for virtues, and he finds that it is quite as easy to discover the former as the latter. In other words, he gets what he looks for.

*From Printer's Ink, a magazine devoted to Salesmanship. Apparatus salesmen—at least some of them—take heed.—Editor.

STUD WELDING

The writer believes that wherever it is necessary to apply a stud, drilling of the sheet and tapping out the hole should be done away with, as it is far cheaper to merely taper the stud at one end and apply a fillet weld around the stud. This in itself would eliminate any possible leak due to a broken or loose stud as the sheet itself remains solid.

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Columbus, Ohio—Central Ohio Welding Co., 200 E. Lynn St.
Corpus Christi, Tex.—Corpus Christi Boiler, Welding & Machine Works, Cor. Laguna and Chaporral St.
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Pueblo, Colo.—Pueblo Carriage Co.
Richmond, Va.—F. D. Schluter Auto & Welding Co., 1009 W. Broad St.
Reno, Nev.—Central Auto & Machine Works, corner 5th and Sierra Sts.
Rochester, N. Y.—General Welding Works, 87 Cortland St.
Raleigh, N. C.—Republic Service Co., 108 S. Blount St.
St. Louis, Mo.—Scored Cylinder Repair Works, 325 Jefferson Ave., N.
Saginaw, Mich.—J. & M. Welding & Repair Co.
Salt Lake City, Utah—Karl Winter, 719 S. State St.
San Antonio, Texas—General Welding Co., 105 Villita St.
Springfield, Mass.—Hoag Welding Co., 31 E. Court St.
Springfield, Ill.—Romie Fields, Rear 317 S. 3rd St.
Seattle, Wash.—Motor Parts Co., Inc., 815 E. Pike St.
Sawyer, Wis.—F. J. Pies & Co.
Sioux Falls, S. D.—Schmidt & Son, 319 N. Main St.
Sioux Falls, Iowa—W. A. Carlson, 1110 Fifth St.
Scranton, Pa.—Scranton Welding Co., 321 Washington Ave.
Tacoma, Wash.—Lampson Welding Works.
Tampa, Fla.—R. G. Wood, 113 Water St.
Utica, N. Y.—Sherman Sales Co., Inc., 516 John St.
Warren, Ohio—Cooper's Storage Battery Service Co., 102 W. Market St.
Washington, D. C.—Day Welding Co., 43 Sumner Court, N. W.
Wichita Falls, Tex.—McFall Brothers.
Wilmington, Del.—J. A. Dillman, 308 Madison St.
Winchester, Va.—Valley Radiator & Welding Co.
Worcester, Mass.—Central Autogenous Welding Mfg. Co., 98 Union St.
Youngstown, Ohio—C. F. Erb, 722 Madison Ave.
Zanesville, Ohio—Chris. Brownfield, General Delivery.
Montreal, Canada—Pyke Motor & Yacht Co., 374 Notre Dame St.
Regina, Canada—Capitol Welding Shop, 1762 Osler St.
Toronto, Canada—Packard-Ontario Motor Car Co., Ltd., 18 Bloor St., E.
Windsor, Canada—H. B. Holden & Co., 41 Sandwich St.
British South Africa—Ed. Works, Port Elizabeth, Cape Colony.
Melbourne, Australia—Finlay Bros., 322 Elizabeth St.

Established SCORED CYLINDER TRADE LAWRENCE MARK PATENT PROCESS *1862*

Woolworth Bldg. **L. LAWRENCE & CO.** New York City

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Help Wanted—50c per line, minimum 4 lines.
Jobs Wanted—4 lines free.
Other Ads—75c per line, minimum 4 lines.
Counted 8 words to line. Add 6 words for keyed address.

Wanted—Salesmen, Demonstrators, Welders and others meeting the welding trade to solicit subscriptions to *The Welding Engineer*, or furnish names of possible readers. When you put your friend or customer in touch with this publication you do him a real favor—make it possible for him to learn more about autogenous welding, liberal proposition. Write me now. Yours for welding, Mackenzie.

ATTENTION, WELDERS & GARAGEMEN

We can furnish you with a SCORED CYLINDER MATERIAL with complete instructions for applying the same at $4.00 per bar, experience not necessary, our flux does the trick. We are the Inventor of the Johnson Patented Engine Suport Bracket for Ford Automobiles, and used before as a prevention, or after braek occurs in crank case. Price $1.50 each. Wilkes-Barre Welding Co., Wilkes-Barre, Pa. Established 1910.

Salesmen

to train and take charge of our new district offices. Must be experienced in demonstration of oxy-acetylene welding and cutting apparatus. Give full particulars with first letter.

Torchweld Equipment Company
224 North Carpenter Street :: :: Chicoag
2t-June-July

For Sale: Two 100-pound Davis Bournonville acetylene generators, $150 each; 1 20-pound Davis Bournonville acetylene generator, $20. Weldrite Co., 104 Hunter Avenue, Long Island City, N. Y. 4t-4-5-6

Wanted—2nd hand carbide kegs. Size approx. 12½" diam. x 23" high. Must be in good condition with either friction or screw lids. Advise quantity. Address, C. K., care *The Welding Engineer*. 4-t-2-3-4-5

Superior Brazing Compound

A product of years of time and study. Over 98 per cent pure boron. Its use is not attended by deposit or scale. Acts as a superior flux and purifies the brazing spelter, causing spelter to flow evenly into every part of joint, without deposit, scale or enamel. A trial will convince the experienced welder of the merits of Superior Brazing Compound.

If your dealer cannot supply you, we will.

Standard Mfg. Co.
318 S. Canal St., Chicago

Job Wanted—Acetylene and electric welder, experienced on marine, machinery and boiler welding, wishes job after July 1st. Capable of taking charge of men, having been employed in that capacity for one year. Any part U. S. Address No. 21, care *The Welding Engineer*. 1t-June

VACANCIES

The Alexander Milburn Co., of Baltimore, have opportunities for several executives and salesmen thoroughly experienced in both manufacturing and sales departments of the Oxy-Acetylene industry.

Address in confidence, stating age, experience and earning capacity.

Wanted—High Grade Salesman for Chicago and Local Territory, experienced in handling Welding and Cutting Apparatus, Oxygen and Supplies. Salary and Commission. Address Box 16, care of *The Welding Engineer*.

Consulting Engineer—An engineer formerly connected with a large manufacturer of acetylene gas seeks consulting work. Thoroughly understands apparatus of all kinds and would strengthen the organization of any apparatus manufacturer. Address 18, care *The Welding Engineer*.

Increase your earning power by learning how to make the fluxes in your own shop. Write for prices on formulas today. American Flux Company, Box 153, Madison Square Station, New York City.

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WELDING ENGINEERS
SOLICIT YOUR DIFFICULT WORK
Distributors of Rego Apparatus
ALL TYPES OF REGULATORS REPAIRED
246 Central Ave. Newark, N. J.

First class gas welder, must be expert on all kinds of aluminum, cylinders and chassis work. Permanent position, excellent salary. Weldrite Co., 104 Hunter Avenue, Long Island City, N. Y.

For Sale—Complete new welding plant, Davis-Bournonville Torch (Tips 3-4-6-7-8-9-10), Nagledinger Regulators, United States gauges, hose etc. Bargain at $100. Seiler Welding Co., 246 Central Ave., Newark, N. J. 1t-June

HOSE BARGAINS

We have a large quantity of brand new welding and cutting hose. Will sell for less than the factory charges for it. This hose was in a warehouse in which there was a fire, and we bought it from the insurance companies. It is guaranteed absolutely perfect and brand new.

The No. 1 copper woven hose is discolored, but is absolutely perfect. All rubber hose is perfect in appearance as well as in quality.

Sizes in stock are: ¼-inch I. D. copper woven, ¼-inch I. D. 7 ply red, ⅜-inch I. D. 7 ply black, ⅜-inch I. D. 2 ply moulded corrugated red, ⅜-inch I. D. 2 ply moulded corrugated black. Dealers, write us for samples and quantity prices. Users, stock up on this hose, as it is a bargain. Address No. 20, care *The Welding Engineer*.

For Sale—6 No. 50 Colt light acetylene generators; all new merchandise in original packages. Will make interesting price on lot. General Welding Products Co., 1415 Broadway, St. Louis, Mo. 1t-June

Look at this Bargain in Welding Rods!

During the months of June and July, we offer for immediate shipment, the following rods, in lots of 100 pounds or more, at the special prices shown.

1/8" K-O Cast Iron Rods, 24" Long, Per Pound	12½c
1/4" K-O Cast Iron Rods, 24" Long, Per Pound	11c
5/16", 3/8" and 1/2" K-O Cast Iron Rods, 24" Long, Per Pound	10½c
1/8" NORWAY Iron Rods, 36" Long, Per Pound	13¼c
5/16", 1/4", 5/16" and 3/8" NORWAY Iron Rods, 36" Long, Per Pound	13½c
1/8" Pure Drawn Tobin Bronze, 36" Long, Per Pound	66c
1/4" Pure Drawn Tobin Bronze, 36" Long, Per Pound	57c
1/4" and 5/16" K-O Cast Aluminum Rods (or drawn), Per Pound	89c

F. O. B. Louisville, Kentucky.

With an order for 100 pounds of any of the above rods—either an assortment, or any particular size you prefer—we will include, free of charge, a copy of Dunham's Book on Automobile Welding. If you order 200 pounds, we will send you without charge, one pair of fibre welding goggles.

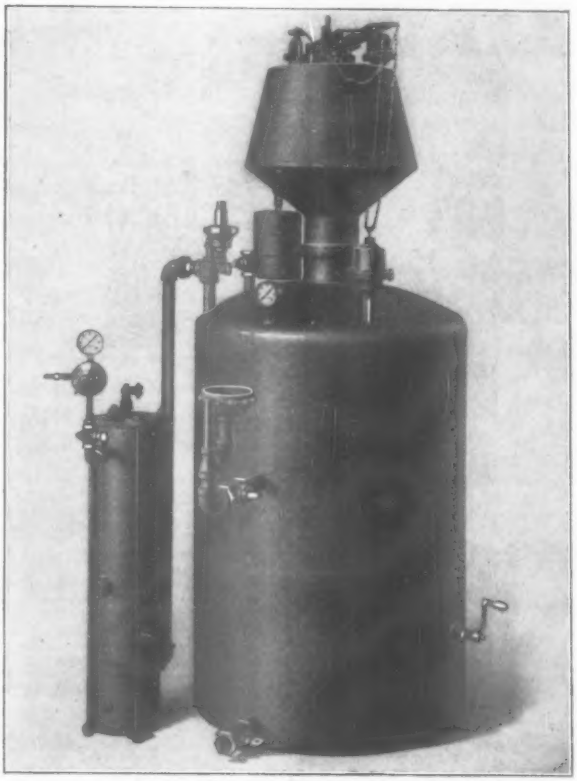
They are our regular stock of rods, and we absolutely guarantee them to be of the highest quality. If they are not exactly as represented, you have the privilege of returning same, and your money will be refunded.

Our KENTUCKY Acetylene Generator Ought To Be Installed in Every Welding, Machine Shop, Garage or Industrial Plant Where the Oxy-Acetylene Welding Process Is Operated Extensively.

How many good-paying jobs do you actually sacrifice every month, on account of being without acetylene?

Why not purchase our KENTUCKY Generator and make your own?

You can manufacture it at about 1¼c per cubic foot with a KENTUCKY Generator.



Or, do you prefer to pay 4c or 5c, and be annoyed with the constant shipping back and forth of cylinders to be refilled and all the red tape incident thereto?

Stop that leak in your profits!

Write us for full information.

25 Pound Size	$215.00
50 Pound Size	235.00
100 Pound Size	340.00
200 Pound Size	595.00
300 Pound Size	790.00

KENTUCKY OXYGEN HYDROGEN COMPANY, Incorporated

Manufacturers of Oxygen and Hydrogen
Distributors of REGO Welding and Cutting Apparatus

LOUISVILLE 1420 Magazine Street KENTUCKY

Wanted—Really good acetylene welders on general machine and automobile work (except aluminum). Steady job, wages $10 ten hours. Board $2.00. Brown Welding Co., Ranger and Breckenridge, Texas. T. F.
1t-June

Job Wanted—All around welder, experienced in thermit, electric and oxy-acetylene welding; 6 years experience. Prefer job as foreman. J. H. Ady, Box 166 Leetonia, Ohio.

CERTIFICATES OF PROFICIENCY

Under certain conditions *The Welding Engineer* will issue Certificates of Proficiency, covering all metals, to welders who are successful in passing a rigid examination. Particulars will be furnished to interested welders upon request. —*The Welding Engineer.*

Special Offer—Our aluminum solder jobs guaranteed stronger than any aluminum casting. Sterling aluminum solder in service tests 22,000 pounds to sq. in. Builds up broken castings good as a weld. Guaranteed permanent. Contains no lead to deteriorate. Regular price $4.00. To dealers five pound lots $12.50 F. O. B. Chicago, cash with order or C. O. D. Money back if not satisfied. Railway & Mill Supply Co., 1412-1414 S. Michigan Ave., Chicago.
1t-June

WANTED

Salesmen, foremen, welders etc., to introduce The Welding Engineer to their friends. Liberal Commission.

Write for details

THE WELDING ENGINEER

Job Wanted—Married man, 27 years old, 5½ years welding experience as salesman and demonstrator. Prefer job as salesman, demonstrator, or can take charge of welding deparment. Gilt edge references. Address Louis S. McCue, 537 Bergen St., Newark, N. J. 1t-June

For Sale

2 Davis-Bournonville Acetylene Generators Capacity 300 lb.-1¼ ⅜ Nut Carbide Producing 300 cu. ft. gas hourly. Used but five months

$600.00 Each

2-10 tank Oxweld Acetylene Co. oxygen manifolds

$200.00 Each

2-10 tank Acetylene manifolds

$200.00 Each

Address 22, Care The Welding Engineer

Mr. L. B. Mackenzie, Editor,
Welding Engineer, Chicago.

Chicago Local Lodge No. 301, Brotherhood of Gas and Electric Welders and Operators of America, Incorporated, held their first meeting of the Charter Members Tuesday, June 8th, at No. 59 East Van Buren Street, Chicago. Election and installation of officers and much other important business was transacted.

Mr. Charles H. Knight, Illinois State Organizer, reported on the progress made up to date in the organization, and the members present reported over seventy-five new applications for membership.

The Organizer also reported the instituting of another Local Lodge about to be organized in the South Chicago District, and extended a very cordial invitation to all Welders in Chicago and a radius of one hundred miles or more to join with us in the forming of an association of our own.

Several Brotherhood members of other A. F. of L. crafts were present by special invitation, all of whom to the last man expressed a desire to become affiliated with us, and a membership committee of fifty was appointed to spread the good news to all parts of the City and State.

The Organizer also read letters received from some ten different States asking advice and information as to organizing Local Union Lodges in these States, and many of them asked for admittance into our First Chicago Local. All outside inquiries will be promptly answered, and assistance rendered in organization throughout the state in the larger cities, and we give a special invitation to the smaller towns to unite with us in the First Chicago Local, No. 301.

Weekly meetings will be held until further notice.

Sincerely and fraternally,
O. C. Mason, Financial Secretary,
C. H. Knight, Rec.-Secy., and Ill. State Organizer.
521 West Jackson Boulevard, Chicago.

The International Railway Master Blacksmiths' Association will hold their next annual convention at the Tutwiler Hotel, Birmingham, Ala., August 17th to 19th, inclusive.

Captain Charles H. Wallace has been appointed marine manager for A. F. Mitchell & Son, Chicago, boiler repairs, electric welding, and machine work.

Not To Be Taken Seriously

Wanted: Ex-doughboy, now a welder, wants address of Ex-top sergeant now welding. Have defective apparatus to dispose of. Address care the Editor.

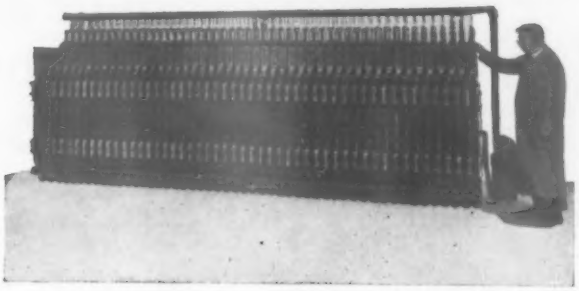
Wanted: Competent all-around welder, four months' experience in barrel factory wants *position*. No reasonable offer under $1.25 per hour refused. Will go anywhere except Pacific Coast, Atlantic Coast, Philadelphia or Chicago.

Wanted: Competent lady welder (blonde, perfect 36) wants situation as welder. Heavy castings preferred. Also willing to do cooking and light washing for the boss and his family. Wages no object. Address, Foolish, care The Editor.

Note: Don't answer the hussey. Besides, we have made her an offer.—Editor.

Wanted: Young man of 22, very pleasing personality, 13 years' experience as welder seeks foreman's job. Address the poor suffering Ed.

Notice: During the hot season, and because he doesn't get a vaaction this year, the Editor of this sheet positively refuses to listen to fellows who want salesmen and good welders, unless the job pays not less than $15,000 per year. In that case we can promise *immediate* results.—Ed.



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Equipment for All Purposes

CUTTING TORCHES which use any preheating gas.

INJECTOR TYPE WELDING TORCHES

EQUAL TYPE WELDING TORCHES

REGULATORS THAT REGULATE

TORCHES MADE SPECIAL FOR GAS MANUFACTURERS

The Harris Calorific Co.
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RED SEAL CAST IRON FLUX	Per lb.
1 to 5 lbs.	$0.50
5 to 10 lbs.	.45
10 to 25 lbs.	.42
25 to 50 lbs.	.40
50 to 100 lbs.	.37
100 lbs. or over	.35

Prices on FLUXES for other metals furnished upon application.

Cast Iron Rods, Welding Wire for Steel, Aluminum Rods, Tobin Bronze.

Write for Jobber's prices.

Memphis Welding Co.
MEMPHIS, TENN.

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ALLWELD

This is not intended to entirely replace aluminum welding, but a real aluminum solder is a most desirable asset in the welding shops. All detrimental characteristics of so called Aluminum Solder are eliminated. Write for sample.

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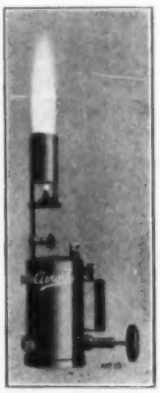

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The Torch of a Thousand Uses.
Handiest Tool for any Shop.

Heat as you want it where you want it when you want it

Preheating Outfits for all requirements.

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Its value proven in the Old World
Is now the wonder of the Whole World

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Swedish Welding Wire

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Generators from 15 to 300 pounds capacity. Acetylene and Electric Welding materials. Fluxes for Cast Iron, Brass, Bronze, Aluminum and all other metals.

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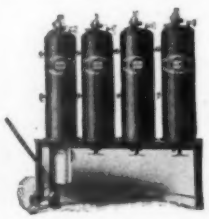
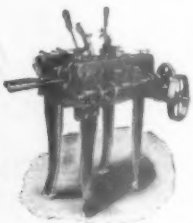
BOOKS ON WELDING

Write for list of books on welding.
If it's in print we have it.

THE WELDING ENGINEER
608 S. Dearborn St. CHICAGO, ILL





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FIRST CLASS REFERENCES
Special Welding MACHINES, guaranteed no flash back cutting and welding torches, and supplies.
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Bermo Welding Plants
OXY-ACETYLENE
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Guaranteed. Write for Catalog and Easy Terms
$25 to $250
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ONE of the uses for the oxyacetylene torch in ship construction.

Here the operator is heating a slightly over-size keel plate to permit of sufficient expansion in the center to draw the member into place.

The rendering of good oxygen and acetylene service means best results in the use of the oxyacetylene process. Airco Oxygen and Acetylene Service is Good Service.

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Users of **Commercial Acetylene** are as sure as scientific care can make them, of a gas of uniform purity and dependability. Alike in the biggest or the most delicate welding or cutting job, it will demonstrate its superior efficiency.

By efficiency we mean what you mean—clean, swift work at minimum cost. Give **Commercial** a trial.

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